Issue #304

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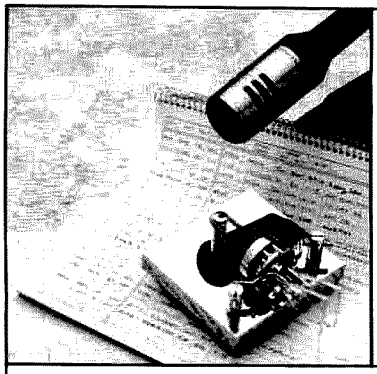
Simple C-64 Printer Interface

Shifty RTTY Filter

1986 Awards Program



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73 for Radio Amateurs®

ISSUE #304 JANUARY 1986

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WHAT?

News from KW1O

Four things happened recently that set alarms clanging in my mind. Taken separately they seem innocuous enough, but it really wasn't until the fourth incident that I remembered the other three things and they all came together in a pattern. Here's what happened, in no particular order:

- On the local packet bulletin board I see a product release for TAPR's new TNC-2. It gives a technical description of the unit, a price, and an address and a telephone number to write or call if you want to buy a TNC-2.
- Lee Shoblom asks the FCC to let him use the 432-MHz ham band to gather news for his low-power television station.
- Chet Lambert of *Computer Trader Magazine* announces his Packet Sweepstakes—a Worked-All-States contest that promises valuable prizes to the winner.
- During the Mexico City earthquake, television networks use amateur radio to coordinate production schedules and to order parts and equipment.

Dingdingdingding!

There are two types of trouble here. In the first, a person or organization outside of amateur radio is trying to use the hobby for personal gain. In the second, the threat is from within our ranks, but the goal is the same. Commercialism, external and internal.

Outies...

External commercialism is something we can deal with easily. They FCC gives us plenty of time to comment on petitions that might affect ham radio adversely, and the ARRL does a pretty good job of keeping us all informed.

The Mexican earthquake made it obvious that the Commission had rather vaguely defined the rules of conduct during a communications emergency. In fact, they had rather vaguely defined a communications emergency. The major news organizations pounced on the loophole *before* the earthquake, and the League pounced on the **FCC**, asking for a reconsideration of the rules. What went on *after* the quake is a travesty. Fortunately the Commission agrees and I don't think it will happen again.

Now, take Lee Shoblom. Here is a fellow who owns a television station out in the boonies and wants to use ham radio to transmit video back to his studio. Can you blame him? Why should Lee shell out **$30,000** for a remote link when he can buy a Creepie Peepie and some ham gear for five hundred bucks? The best part is this: The local amateurs think it's a *wonderful* idea. Well, I think it *stinks*. We might as well hand over the keys to our UHF spectrum. And while we're at it, we could give cabbies the two-meter band (I hear they're already using it in New York). Since this is external commercialism, we have plenty of time to examine what's going on and to act appropriately.

...and Innies

Internal commercialism is more insidious. It's a lot harder to define. And because it is perpetrated by people we know, we're less likely to call it out. But that doesn't make it OK.

The spread of internal commercialism is directly linked to the growth of packet radio. The reason is simple: The act of communicating has shifted from the radio to the keyboard. What appears on the screen of your terminal is the same whether you use a VHF channel or a telephone line for the connection, so it seems very natural to transfer information from one computer to another.

The "ad" I saw for TAPR's TNC-2 was probably lifted from CompuServe® and deposited on our local packet bulletin board. In fairness, I must point out that its "wrongness" was felt by several individuals who read it, and it was eventually removed from the airways. But how do we know if something is commercial? In the TAPR case the matter was clear-cut, but consider this: A message is placed on a packet board which announces the availability of a new piece of hardware. No price is given, but an address is supplied so that you can get more information. Commercial? I say that it is, because the message will eventually create a sale for the company producing the hardware. Or try this: Excerpts from an amateur-radio newsletter are made available on a packet bulletin board. Commercial? Again, I have to say that it is, since the excerpts could be considered an advertisement which would make a sale for the publisher. This kind of internal commercialism is going to get worse as our hobby matures unless strong measures are taken *now*.

Finally, Chet Lambert's Packet Sweepstakes. I group this under Internal commercialism because Chet is a ham who dearly loves amateur radio, not some sinister corporation trying to hoodwink us. Nevertheless, the idea still smacks of commercialism. Look—if someone is willing to give you a VHF transceiver for working 50 states on packet radio, how long will it be before you can get a Buick for winning the *CQ* WW PX contest?

Reaction to the Sweepstakes, at least here in New England, has been negative among experienced packeteers. And I

Continued on page 84

MPA

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QRX. . .

EDITED BY PERRY DONHAM KW1O

SOS DE USQS

THERE'S BAD NEWS from Laryl KM7Z at the **United States QSL Service (USQS)**. The bad news is that USQS is no more. For those of you not in the know, USQS was an incoming United States QSL bureau, handling DX *and* stateside cards. I don't imagine that the volume of DX cards coming in was very high (the ARRL bureaus have that end locked up), but the beauty of USQS (and the reason W2NSD/1 kept envelopes there) was the fact that *stateside* hams could send cards to *other* stateside hams in bulk. For free. In fact, if you sent along a few dollars for postage, Laryl would *look up* addresses for you and mail the cards out! Luckily, **Bill Wellborn K4CLA** has stepped in to fill the void with **KIQS** (Bill says to pronounce it "kicks"), which stands for the **K4CLA Incoming QSL Service**. Here's how it works: Send Bill a dollar for four stamped envelopes, which he will keep on file. Sort your outgoing (US only!) cards by call area, then alphabetically by suffix and send them to KIQS. Bill stuffs the on-file envelopes and sends cards out four times a year: in January, April, July, and October. The address for KIQS is 562 Oak Drive, Lexington SC 29072-9059. Laryl's USQS is returning all unused SASEs to their owners.

Hot Shots

IS IT TIME to start a monthly magazine called *Hams In Space*? It seems likely, with the announcement of two more possible missions. In March, 1986, **Dr. Ron Parise WA4SIR** will be aboard shuttle mission 61-E (Astro-1) as a Payload Specialist. Dr. Parise is an astronomer and will be making observations of Halley's Comet and other celestial objects. Ron has let NASA know that he would like to operate a packet-radio station from the shuttle; another first for ham radio! AMSAT is working with Ron in coordinating the operation. **Dr. Owen Garriott W5LFL**, America's first ham in space, is scheduled for a flight on mission 61-K, set for a September, 1986, launch. Owen will undoubtedly seek permission to operate from space.

Look! It's . . .

HALLEY'S COMET (rhymes with tally, though some swear it rhymes with holly) is getting brighter, and the hoopla surrounding it is getting really intense. There's Halley's Comet T-shirts, Halley's Comet Expeditions ($1,500–$5,000), "special" Halley's Comet telescopes, and so on. Don't think that hams have been forgotten; there is now a Halley's Comet Radio Watch. Project coordinator **Tania Miller WB9TKC** is looking for reports of unusual conditions on all bands, including amateur and CB frequencies, shortwave broadcast bands, and television channels. Your report should include the frequency (or band), time, date, your location, and the abnormal condition. Tania is offering a Comet QSL for your trouble. Because of the enormous hype surrounding the comet's return, many people are expecting a spectacular celestial event, complete with a fiery comet that is visible even during the day. 'Tain't so, friends. You'll need expert advice on where to *look* for the thing, and even then you'll need to look *very closely* to find it; a trip to your local book shop for a Halley's Comet manual (there are about a hundred of them) is in order. And don't rush out and buy a high-priced telescope, no matter *what* the ads claim. The best thing to use is a pair of low-power binoculars.

County Bounty

ARMADILLO COUNTY, TEXAS, has been created by a proclamation from Texas Governor Mark White. Between March 2 and December 31, 1986, any amateur operating along the Texas Independence Trail may give his QTH as Armadillo County, Texas, in order to celebrate the state's sesquicentennial. The **Texas DX Society** will be setting up operations along the trail throughout the year to give everyone a chance to work the new county. And Armadillo will be on the air during the massive **1986 Armadillo Run**, an attempt by the TDXS to activate *every county in the United States* (3,077!) during the 1986 County Hunters phone and CW contests (phone on May 3–4 and CW on July 26–27). These guys are really going to pull it off—they've spent the last year or so setting up regional and sectional coordinators all across the country. In 1983, club members operated from every county in Texas (254 counties). In 1984, the project expanded to cover Texas, Arkansas, Louisiana, and Mississippi! If you want up-to-the-minute information about the 1986 Run, get in touch with Tom Taormina K5RC, 3940 Bahler Avenue, Manvel TX 77578.



Texas Governor Mark White (center) creates a new county. That's KZ5M on the left and K5RC on the right. Photo by K5RVK.

Canada Tries

CANADIAN AMATEURS got some good news and bad news regarding the Canadian Radio Relay League request for early access to the WARC bands. First, the Minister of Communications said that before any privileges on the 24-MHz band were granted, commercial stations occupying the band would have to be either shut down or moved to another part of the spectrum. Also, certain amendments to the General Radio Regulations would need to be made, something that has in the past taken years to accomplish. Only a month later, the Minister announced that most commercial users of the 24-MHz band had been removed and that the process for amending the rules could begin soon. He also noted that an amendment to the Regulations was already under way to allow amateur use of the 18-MHz band, which had already been cleared of commercial users.

Goldwater Winner

THIS YEAR'S Goldwater Scholarship Award went to 18-year-old Clark Barrow KI4UT, of Cocoa, Florida. Clark plans on a career in satellite communications doing research and development. He is working at NASA's Kennedy Space Center at a job won as a prize in a science contest. Clark said that he will use the $5,000 prize to help pay for an Electrical Engineering degree from Auburn University.

Weirdness

DON'T TOUCH THAT DIAL! In fact, don't even turn on your receiver! Legislation introduced into the House of Representatives by Robert Kastenmeier (D-Wisconsin) and Carlos Moorhead (R-California) would, if signed into law, make the reception of nearly every type of radio transmission a Federal offense. The **Electronic Communications Privacy Act of**

1985. HR-3378, is the name of this travesty and its backers (mainly the cellular-telephone industry) want to make it a crime to receive any radio signal that does not fall into one of these categories: distress calls, Amateur Radio Service, Police or Fire Radio Service, CB, broadcasts intended for the general public, and walkie-talkies. What this Bill tries to do is extend the laws against wiretapping to the radio spectrum. In fact, *monitoring an amateur-radio phone patch* would be illegal under this proposal. This is obviously absurd, but the Bill has *strong support* and *not much resistance!* Sit down *right now*, write a letter to your Congressmen, and tell them that you think that HR-3378 is a direct attack on your rights as a citizen of the United States.

30 Days

30 DAYS HATH SEPTEMBER, but not exam applicants, says the FCC. You no longer have to wait 30 days before retaking a license exam that you have failed. The Commissioners felt that, "There is no persuasive evidence in the record that an applicant who has waited 30 days between tests will be better prepared for the next test than one who has waited 27 days, or 13 days, or 7 days, or any other period of time." The existing regulations covering the Volunteer Examination program already specify that questions must change from test to test, so there won't be a problem with someone taking a test on Saturday and seeing the same questions on a Sunday test. And, since each VE Coordinator creates its own tests from a large pool of questions, it's not likely that two VECs will prepare identical exams.

Who's On First?

IT LOOKS LIKE the absolute very first legal amateur signal on the new 900-MHz band was transmitted by **K9MK/R**, a repeater built by **Mike Krzystyniak K9MK/5, Bill Cantrell WD5CVG, and Greg Raven KF5N.** These guys, all members of the Motorola Amateur Radio Club, decided to beat everyone to the punch and built a complete repeater system out of surplus Motorola mobile radios in under three weeks! The machine has an input of 908.000 MHz and an output of 920.000 MHz and serves a four-county area near Ft. Worth, Texas. Another Motorola repeater can be found in Chicago on 909.000/921.000 MHz serving the northwest suburbs.

XE Permits

MEXICO IS UNOFFICIALLY granting temporary amateur licenses to US citizens visiting the country. In a story which appeared in the *W5YI Report*, **Chris Petroff N5HQN/XE2BSG** reported that the Secretariat of Communications and Transport has authorized the licenses. The temporary permit is valid for the length of the amateur's visit to Mexico as stated on his or her visa. Petroff believed that the permit was for a Class II Mexican license, which allows 250 Watts on HF and 100 Watts on VHF.

Roll 'Em

IF YOU MISSED the action during space-shuttle mission 51-F (Tony England W0ORE and John-David Bartoe W4NYZ), take heart. Copies of the tapes Tony and John-David used to log are now available from the American Radio Relay League. Just send League archivist **Karl Townsend** the date and orbit number that interests you and he'll generate the tape that you need. (You might want to write or phone first to check out prices. If you write, enclose an SASE.) Videotapes of the SSTV images sent to and from *Challenger* are also available. Robot, the company that manufactured the 1200C scan converter carried on the mission, is working "between the lines," using arcane techniques in an attempt to recover as much of the uplinked video information as possible. In many cases there were so many signals competing on the frequency that only bits and pieces of video appear on the tapes. QSL cards are available from the ARRL for two-way contacts, reception reports, confirmed reception by *Challenger* of uplinked SSTV, and so on. Send an SASE to the ARRL, 225 Main Street, Newington CT 06111.

Erratum

PAGE 82 of our November, 1985, issue contains an error. In our review of the **ICOM IC-735. N1BLH** says that the rig's microprocessor gets its instructions from a lithium-battery-backed RAM. A conversation with ICOM revealed that this is not the case. Only the memories are battery-backed: The instructions are stored in a ROM.

Prefix Mix

THE PREFIX FOR CT2 AZORES has been changed to **CU.** The number after the prefix now refers to each of the nine islands of the Azores Archipelago: CU1 Santa Maria, CU2 Sao Miguel, CU3 Terceira, CU4 Graciosa, CU5 Sao Jorge, CU6 Pico, CU7 Faial, CU8 Flores, and CU9 Corvo. CU0 is reserved for repeaters. Some CT2 amateurs now have completely different calls, while others have only a different prefix. There also is a new address for the Azores QSL Bureau: it's Associacao de Radioamadores dos Acores, PO Box 211, 9 503 Ponta Del Gada, Azores Islands.

Status Quo

GORDON GIRTON W6NLG wants the FCC not to issue any more "preferred" callsigns. His petition to the Commission requests that all 1-by-3 K and W calls be removed from the list of available callsigns until all other combinations have been exhausted. Gordon notes that many hams equate 1-by-3 K and W calls with the number of years licensed—most of those calls are held by "old-timers" and can be seen as a sort of status symbol. WA, WB, and WD calls are also covered in the petition. There's been no word from the Commission on this one, yet.

Land of OST

THERE'S A CHANCE that RM-4829 and RM-4831, the Dockets before the FCC dealing with land-mobile use of our 220-MHz allocation, are dead. **Tom Stanley**, Deputy Chief of the Office of Science and Technology, has been named to fill the OST Directorship vacated by Bob Powers. Both RM-4829 and RM-4831 were being handled by the OST, and it may take quite some time before the new administration decides what should be done about them. **Art Reis K9XI**, Editor of *220 Notes*, feels that the issue is indeed dead and that the only reason the FCC would bring out either Docket as a Notice of Proposed Rulemaking would be to resolve the question of Land Mobile Service interference to television channel 13.

Free Press

AT THE RISK of causing a strike at the *73* mail room, we're making available yet another freebie! This time your SASE will net a **Genuine FCC Emission Classification** List. No longer will you have to remember all of those silly numbers and letters like J3E, A1A, and F3E—you'll have the entire list right at your fingertips! This list is essential to accurate logging, and no ham should be without it. Get your free copy by sending an SASE to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: Emissions.

Thanks

THIS MONTH, "QRX" comes to you courtesy of *Gateway, Westlink,* the Personal Radio Steering Group, *220 Notes,* the North Florida ARS *Balanced Modulator, The VHF Journal,* and the Arizona Repeater Association *Squelch Tail.* Send your "QRX" items (photos, too!) to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: QRX. And have a great 1986!

Thomas C. Johnson WB6NQK
2056 E. Sutter Place
Oxnard CA 93033

More Cheap Talk

Here's the beginning of the end of your sanity — a text-to-speech algorithm that lets your computer speak its mind!

As promised in my article, "Talk Is Cheap" (*73*, October, 1985), I have developed a text-to-speech algorithm for the speech synthesizer I described, and in this article I will present what I came up with. Before getting into the details, let me review the basic hardware and software which make up "Cheap-Talker."

Hardware

The hardware used is an APPLE II bus-compatible circuit board. The schematic is shown in Fig. 1. It uses the SPO256 voice-synthesizer chip manufactured by General Instruments and marketed by Radio Shack as part no. 276-1784. This chip retails for $12.95. When you go to Radio Shack to purchase it, make sure you do not mistakenly buy part no. 276-1783. This also is a voice-synthesizer chip but it uses an external ROM to produce only 36 words. It also does not come with the comprehensive technical data pamphlet accompanying 276-1784. The latter will have "SPO256-AL2" stamped on it.

Cheap-Talker also uses an MC6821 parallel interface adapter for communications with the Apple bus. Port B is used to transfer data from the computer to the synthesizer. The CB2 line provides a negative-handshaking pulse whenever data is written into port B. This signals the synthesizer that data is ready. The LRQ (Load Request) line is connected to bit 7 of port B so it can be tested easily to find out if the synthesizer is ready for yet more data.

I've also used the LM386 audio amplifier as recommended in the data sheet. It works very well, providing an adequate volume for normal indoor use. This circuit can be constructed by the freehand etching of a circuit board or wire-wrapping on a protoboard. I have done both with equal success.

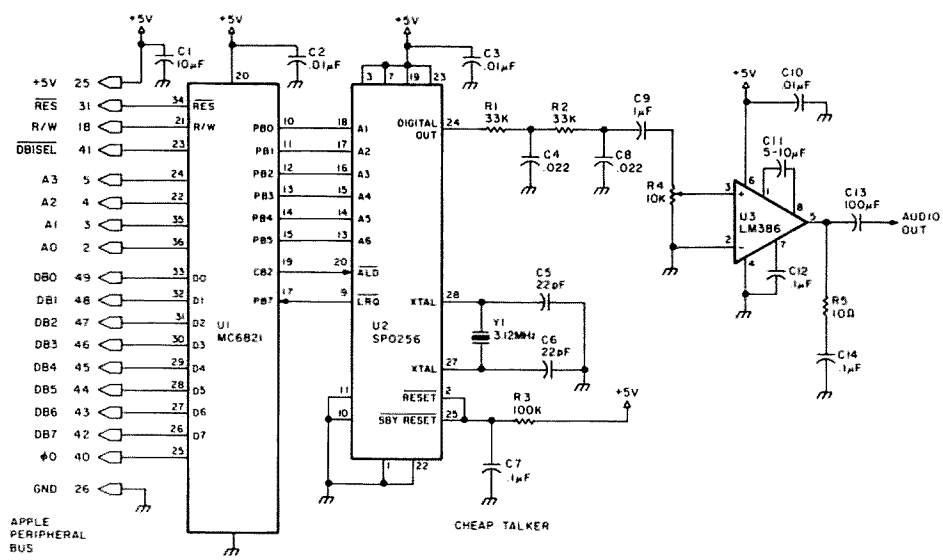


Fig. 1. Schematic of the Cheap-Talker.

Software

The software driver used to make the chip work is shown in Listing 1. The entire driver program and allophone buffer fits in just 208 bytes. The program alone is only 48 bytes. This program, when called at location $300 (768 decimal), will send the allophone codes in the allophone buffer located in locations $341-$3CF (833-975 decimal) to the synthesizer, one at a time. Location $340 (832 decimal) contains the number of allophones to be sent; it allows 142 allophone codes to be sent, which is more than enough for most messages composed of a number of words. Most words contain fewer than 20 allophone codes. Since the text-to-speech algorithm translates only one word at a time, there is plenty of room in the buffer to speak even the longest of words.

The INIT portion configures port B of the 6821 chip to have bits 0-5 in the output mode and bits 6-7 in the input mode. Bit 7 is used to monitor the LRQ pin on the synthesizer to find out when it is ready for another allophone. The CB2 pin is put in

the "pulse on write" mode which sends a negative pulse out when data is written into port B. This signals the synthesizer that the allophone data is ready.

Note that the addresses for the PIACRB (Control Register B) and PIADPRB (Data Direction and Peripheral Register B) registers are offset in lines 15 and 16 for use in slot 3 of the Apple. If you are using an assembler which uses similar nomenclature, you could change the slot by changing the $30 to $x0, where x is the slot number. If you are typing in the hexadecimal values for the program, you would change the $BF in locations $303 and $30D to $8F + $n0 where n is the slot number. You would also change the $BE in locations $308 and $327 to $8E + $n0.

The SPEAK routine takes the allophones and sends them to the synthesizer via the PRONOUNC routine. SPEAK uses the value in location $340 to initialize the Y register as a counter to keep track of the number of allophones sent. The X register is used as a pointer to the various values in the allophone buffer.

The PRONOUNC routine saves the allophone data in the accumulator on the stack while it checks the LRQ line to see if the synthesizer is ready for the next allophone. It does this by reading the value in bit 7 of Peripheral Register B which, as was mentioned earlier, is set up as an input. If bit 7 is a 0, then the synthesizer is ready to receive data via Peripheral Register B.

This simple hardware/software combination forms the basis of the speech synthesizer system I call Cheap-Talker. The text-to-speech algorithm and rules I will describe next will use it to produce unlimited speech based on English words sent to it.

```
0000                1         TTL 'CHEAP-TALKER'
0000                2 ;
0000                3 ****************************
0000                4 *      CHEAP-TALKER        *
0000                5 *  DRIVER SOFTWARE FOR     *
0000                6 * SPO-256 VOICE SYNTHESIZER *
0000                7 *  BY THOMAS C. JOHNSON    *
0000                8 *       VBANOK             *
0000                9 *      DEC 7, 1984         *
0000               10 ****************************
0000               11 ;
0300               12         ORG $300
0300               13 ;
0300               14 ;
0300               15 ;
C08E               16 PIADPRB  EQU $C08E+$30      ; SLOT 3 DATA DIRECTION AND OUTPUT BUFFER
C08F               17 PIACRB   EQU $C08F+$30      ; SLOT 3 CONTROL REGISTER
0340               18 SOUNDS   EQU $340           ; ALLOPHONE BUFFER- $340 CONTAINS NO. OF ALLOPHONES TO FOLLOW
0300               19 ;                           ; $341-$3CF CONTAIN THE ALLOPHONES TO BE SPOKEN
0300               20 ;
0300               21 ;
0300               22 INIT:
0300 A9 00         23         LDA #0
0302 8D BF C0      24         STA PIACRB          ; ENABLE DATA DIRECTION REGISTER
0305 A9 3F         25         LDA #$3F
0307 8D BE C0      26         STA PIADPRB         ; BITS #-5=OUTPUTS, BITS 6-7 INPUTS
030A A9 2C         27         LDA #$2C
030C 8D BF C0      28         STA PIACRB          ; CB2 IN PULSE MODE
030F               29 ;
030F               30 ;
030F               31 SPEAK:
030F A2 00         32         LDX #0
0311 BD 40 03      33         LDA SOUNDS,X        ; LOAD THE NUMBER OF ALLOPHONES TO SPEAK
0314 A8            34         TAY                 ; USE Y REG TO COUNT
0315 E8            35         INX                 ; USE X REG TO POINT TO NEXT ALLOPHONE
0316 BD 40 03      36 ^1      LDA SOUNDS,X        ; LOAD THE NEXT ALLOPHONE
0319 20 25 03      37         JSR PRONOUNC        ; SEND IT TO THE SYNTHESIZER
031C E8            38         INX                 ; MOVE POINTER TO NEXT ALLOPHONE
031D 88            39         DEY                 ; DECREMENT THE COUNTER...ALL DONE YET?
031E D0 F6         40         BNE ^1              ; NO, DO THE NEXT ONE
0320 98            41         TYA                 ; YES, SEND A PAI TO THE SYNTHESIZER TO END THE WORD
0321 20 25 03      42         JSR PRONOUNC        ; SEND IT
0324 60            43         RTS                 ; DONE
0325               44 ;
0325               45 PRONOUNC:
0325 48            46         PHA                 ; HOLD DATA ON STACK
0326 AD BE C0      47 ^1      LDA PIADPRB         ; SYNTHESIZER READY FOR NEW DATA YET?
0329 30 FB         48         BMI ^1              ; NO, CHECK AGAIN
032B 68            49         PLA                 ; YES, GET THE DATA
032C 8D BE C0      50         STA PIADPRB         ; SEND IT TO THE SYNTHESIZER
032F 60            51         RTS
0330               52 ;
0330               53         END
```

Listing 1.

Algorithm

The algorithm I came up with was inspired by work done at the United States Naval Research Laboratory described in a 100-page report entitled "Automatic Translation of English Text To Phonetics By Means Of Letter-To-Sound Rules." That's quite a title, but it's also quite a fascinating report.

In this report, an algorithm and 329 rules which translate English words into the International Phonetic Alphabet (IPA) are described. The algorithm also converts IPA symbols into the phonetic codes of the synthesizer the Laboratory was using (the Federal Screw Works Votrax VS-6 audio response unit). The software developed for the algorithm was written and described in SNOBOL, and as a result I did not find it very useful in writing my algorithm for the 6502 microprocessor. I did, however, rely heavily on the rules they developed and devised my own algorithm which would utilize those rules and generate the allophone codes used by the SPO256 chip.

The algorithm I developed (called Translator) is written in 6502 assembly code and occupies 2,186 bytes. If a 16K card is available, then it resides in the card at $D000. Otherwise it resides at $7600. It is composed of 37 subroutines, each having a specific purpose. A chart showing the subroutines and their relationships is shown in Fig. 2.

Each subroutine calls upon the subroutine connected to it in the row below it to accomplish its task. For example, TRNSLATE, the main routine, calls these routines to do its job: ILLEGALS, COUNTCHR, FINDRULE, GETRULE, TESTRULE, CHKRULE, ADVRP, DEBUG, APPEND, and SPEAK. In turn, FINDRULE will call the routines PUNCT and NUMBERS, and so on.

When a word is placed in the word buffer and Translator is called, it analyzes each letter in the word and searches the rules to find those which best match the context of each of the letters and uses the allophones associated with the chosen rules to speak the word. This is done in the following manner (please refer to Fig. 3).

First, TRNSLATE calls COUNTCHR to count the number of characters in the input word string, convert them to uppercase if they are not already, and set the MSB in each one. If there are no characters in the word string, TRNSLATE is finished. Otherwise the variables CC, ALOFON, and ABUF are initialized. CC points to the currently testable character in the input word string. ALOFON points to the next position in the allophone buffer to store an allophone code. ABUF contains the current number of allophones in the allophone buffer to be spoken.

Next, the currently testable character is loaded for analysis. If it is an illegal character which can't be translated, it is ignored, CC is moved to the next character in the word string, and the next character is loaded if it is not the end of the word. If the character was OK, FINDRULE locates the rule group which pertains to the character. Then GETRULE loads sections A, B, C, and D from the rule into separate buffers. TESTRULE tests section B, then A, then C to see if they fit. All of them must pass for the rule to pass.

If the rule passed, it is checked by CHKRULE to see if it has a higher priority than any of the previous rules checked in the group. If it does, it records the address and the priority for comparison by any following rules in the group. After

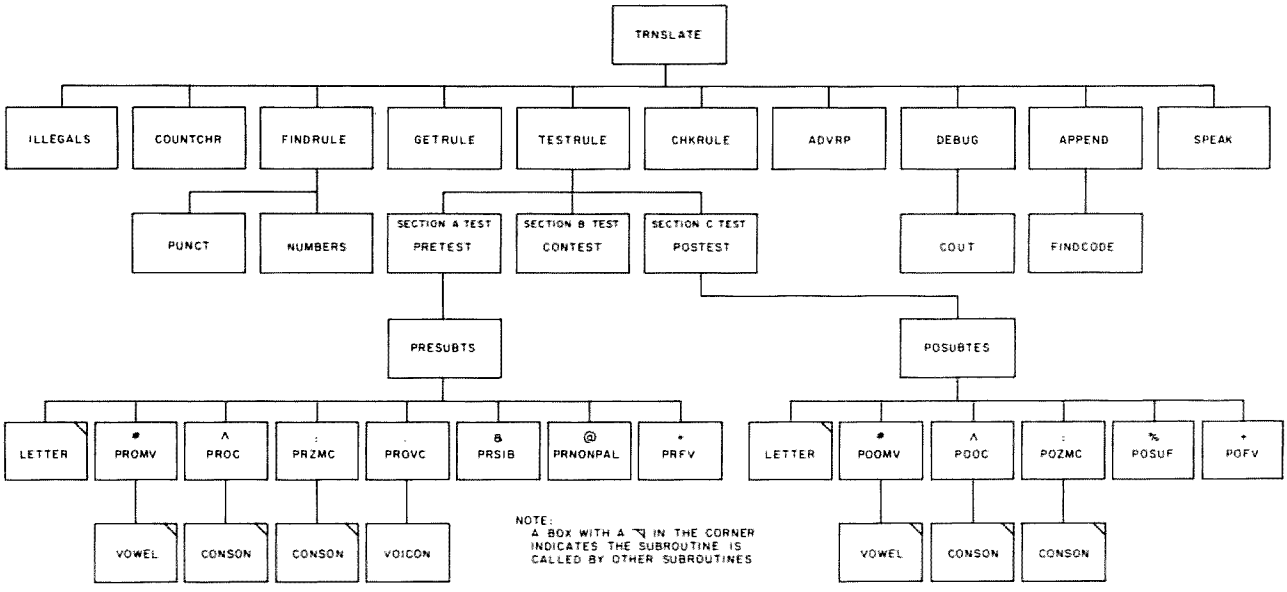


Fig. 2. Subroutine chart, translator text-to-speech algorithm.

that, or if the rule did not pass, ADVRP advances the pointer which points to the current rule in the group to the next rule. If zeros are found, the end of the group has been reached. Otherwise the rule is loaded and tested.

When all the rules have been tested and at least one of them passed, that rule (the one having the highest priority) is again loaded and the DEBUG routine is called. This routine, if the control flag is on, will send the text of the rule to the screen to show which one has been found for the particular character. If the rule included any allophones in section D (some rules do not have any, indicating the character(s) in section B are silent), they are converted to hexadecimal codes and loaded into the allophone buffer at ALOFON by the subroutine APPEND. CC is moved to the next testable character in the word string.

If it has not reached the end of the word (indicated by the presence of a $0D or a $8D carriage return code in the input word string buffer), the next character is loaded and analyzed. If it is the end of the word, the SPEAK subroutine (driver software in Listing 1) is called to send the allophones to the synthesizer.

Rules

Translator utilizes RULES in order to translate a word into its equivalent allophones. These rules occupy a total of 5,290 bytes. If a 16K card is used, then the rules reside in the card at $E000; otherwise they are at

```
TABLE:
; RULE VECTOR LOOKUP TABLE
; ADR generates the address of the designated label in the
table.
        ADR PNCRULES        ; PUNCTUATION RULES
        ADR NUMRULES        ; NUMBER RULES
        ADR ARULES
        ADR BRULES
        ADR CRULES

PNCRULES:
; Rules for pronouncing punctuation marks (various length
pauses).
        STR "(,)=PA5"
        STR "(,)=PA3"
        STR "(?)=PA5"
        STR "(;)=PA5"
        STR "(:)=PA5"
        STR "(')=PA1"
        STR "(!)=PA5"
        STR "(-)=PA3"
        HEX 0000
NUMRULES:
; Rules for pronouncing numbers
        STR "(0)=ZZ YR OW "
        STR "(1)=WW AI NN1"
        STR "(2)=TT2UW2"
        STR "(3)=TH RR1IY "
        STR "(4)=FF FF OR "
        STR "(5)=FF FF AY VV"
        STR "(6)=SS SS IH IH PA3YK2SS "
        STR "(7)=SS EH EH VV IH NN1"
        STR "(8)=EY PA3TT2"
        STR "(9)=NN1AA AY NN1"
        HEX 0000
ARULES:
        STR " :(A)^+ =EY "
        STR " (A) =EY "
        STR "(A) =AI "
        STR "(A)^+0=EY "
        STR "(AR)=AR "
        STR "(A)=AE "
        HEX 0000
BRULES:
        STR "0(B)E0=PA1BB1"
        STR " (B) =PA1BB2IY "
        STR "(B)=PA1BB2"
        HEX 0000
CRULES:
        STR " (C) =SS IY "
        STR "(CI)A=SH "
        STR "(CI)O=SH "
        STR "(CI)EN=SH "
        STR "(C)+=SS "
        STR "(CH)=PA3CH "
        STR "(CK)=PA3KK2"
        STR "(C)=PA3KK2"
        HEX 0000
```

Table 1. Pronunciation rule examples.

RULE FORMAT: A(B)C = D

SPECIAL SYMBOLS USED IN SECTIONS A & C
(these represent calls to subroutines to check for the following conditions)

- # One or more vowels (A,E,I,O,U,Y)
  Used in sections A and C.
- ^ One consonant (B,C,D,F,G,H,J,K,L,M,N,P,Q,R,S,T,V,W,X,Z)
  Used in sections A and C.
- : Zero or more consonants (always passes)
  Used in sections A and C.
- . One voiced consonant (B,D,G,J,L,M,N,R,V,W,Z)
  Used in section A only.
- % Suffix (E,ER,ES,ED,ELY,ING)
  Used in section C only.
- & Sibilant (C,G,J,S,X,Z,CH,SH)
  Used in section A only.
- @ Nonpal (letters which modify the sound of long U)
  (D,J,L,N,R,S,T,Z,CH,SH,TH)
  Used in section A only.
- + Front vowels (E,I,Y)
  Used in sections A and C.

Table 2.

$7F00. These rules are ASCII text strings and are broken into 28 groups. There is a lookup table used to locate each of the rule groups. There is a group for punctuation marks, numbers, and one for each of the 26 letters in the alphabet. Each of the rules in the group is organized according to the priority of the rule, going from the highest to the lowest. A sampling of these rules is shown in Table 1 to demonstrate the format the rules take. Each rule has the form: A(B)C = D—which means "The character string B, which has a left context A and a right context C gets the pronunciation D." B is a letter or group of letters which must match exactly in the source word. A and C are either letters, strings of letters, or special symbols. The special symbols are used to call certain routines to test the appropriate contexts for whichever class of strings is needed. The special symbols used are shown in Table 2.

For example, a # means that one or more vowels must be in the same relative position in the word as the symbol is in the rule. If either A or C is not present, then this indicates that this section of the rule will always pass. A space in section A indicates the beginning of the word, and a space in C indicates the end of the word. D names the allophone codes used to pronounce the letter(s) in section B. These names are later converted into hexadecimal codes to be sent to the speech synthesizer.

As stated above, the rules in each group are organized into four subgroups according to their translation priority. This priority is determined by the contents of sections A, B, and C. Rules with criteria in sections A, B, and C have the highest priority. Rules with criteria in sections A and B and none in C come next, followed by those with criteria only in sections B and C, and finally those with only section B.

When the rules are analyzed in the translator algorithm, each rule is tested and the rule with the largest number of criteria in sections A, B, and C combined will be chosen to pronounce the letter(s) in section B. For example, if one rule had two symbols (criteria) in section A, one in section B, and two in section C (total of five) it would be given lower priority than a rule with no symbols in section A, three in B, and three in C, even though a rule such as the former has a higher priority in the rule group.

You might wonder, why not just put the rules in order of the number of total symbols they have and eliminate some code? Well, that is certainly another way of doing it, and I believe it would work just as well. In the process of writing and experimenting with this algorithm, the former method is the one I settled on; it would require a lot of rule shuffling to convert to the latter method, and there would be very little savings in terms of execution time and code space.

As with all of the computer projects attempted, I have found that for as long as I kept playing with them I would keep changing them and finding new ways to do what I was doing. With something like this, I had to pick a point where the project was satisfactory and stick with it. There is always room to improve. (Enough excuses!)

To summarize how the algorithm works and how the rules are used, let's take the word HOW and translate it into allophones. I will use the H rules reproduced below for reference. Notice the STR before each rule. This is a mnemonic for the LISA™ assembler which tells it to count the number of characters in the quotes and store it in memory at the current address followed by the ASCII codes of the characters.

```
HRULES:
; RULE GROUP FOR LETTER H
   STR "(H) = EY CH "
   STR "(HAV) = HH1AE VV "
   STR "(HERE) = HH1YR "
   STR "(HOUR) = OW ER1"
   STR "(H)# = HH2"
   STR "(HOW) = HH2OW "
   STR "(H) = PA1"
   HEX 0000 ; END OF RULE
GROUP
```

The first character in the word is H, so the rule group selected is the H rule group. Each rule is located and broken into its component sections (A,B,C, and D) and each section is put into its own buffer. The first rule selected is " (H) =EH CH ". Section B will pass because the H in the parentheses matches the H from the word. The A section passes because the H in HOW is the first character. The C section does not pass because the "H" is not the last character. Therefore the rule is not a match.

The next rule is loaded. It is " (HAV) = HH1AE VV ". This time section B does not match because the three

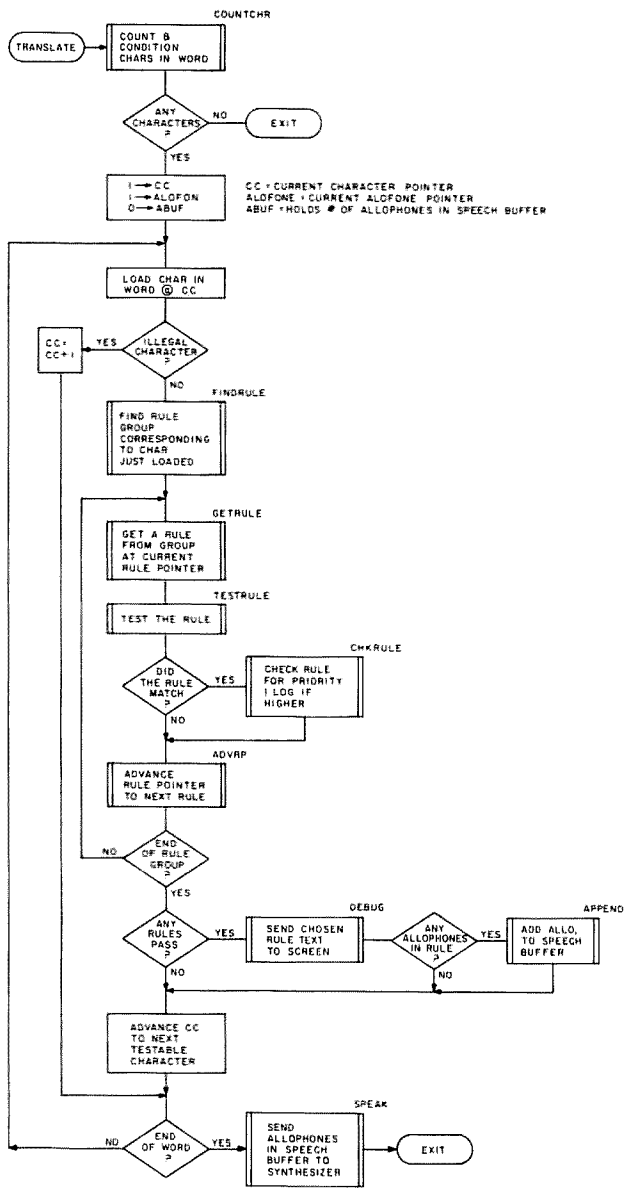
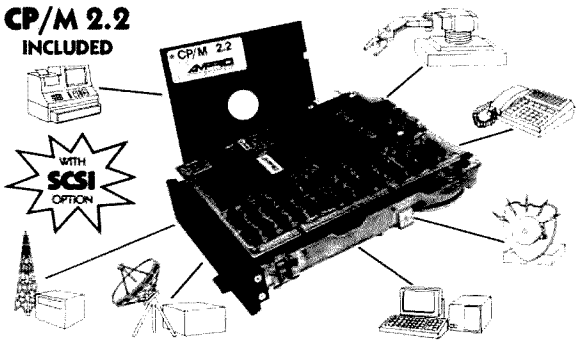


Fig. 3. Translate flowchart.

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characters in the parentheses do not match the three characters starting with H in the word HOW.

The next rule is loaded: " (HERE) = HH1YR ". Again, section B does not match.

The next rule is the same way, but the next rule, " (H)# = HH2", seems to have a chance. Section B certainly matches. Section A also matches by default because there is no criteria to be met—anything may be in front of the H for this rule to pass. Section C has a # in it which means that one or more vowels must follow the H in HOW in order for the section to pass. This it certainly does because there is one O following the H. The rule passes, and the address and priority of the rule (2) are held for future reference. Remember that the priority given to a rule is the total number of symbols in sections A, B, and C.

And now the next rule, "(HOW) = HH2AW ", is loaded for testing. Section B has H, O, and W in it which perfectly matches the three characters starting with H in HOW. Section A has no criteria and therefore passes as does section C. This rule passes and the priority (3) is compared to the current highest (2). Since it is higher, the address for this rule and its priority replace the previous maximums.

The final rule, "(H) = PA1", also passes, but its priority is less than the current maximum of 3 so it is ignored. When the zeros are read in, that indicates the end of the rule group has been reached.

With all of the rules in the H group having been tested, the rule chosen for translation is the "(HOW) = HH2AW " rule. Therefore, those two allophones are converted into their respective hexadecimal codes and added to those (if any) in the buffer which holds the codes to be sent to the synthesizer. Notice that all of the allophone names (HH2, AW) have exactly 3 characters in them. This makes it easier for the Translator program to find and convert them into their hexadecimal codes.

The next thing is to advance the pointer (which points to the character which is being tested) to the next testable character. In this case, it skips over the O and the W because their pronunciations were included in the translation of the H, since they were all in section B. The pointer would therefore move to the next character past the W. But since there are none, the translation is complete and the allophone codes are sent to the synthesizer. (If the word had been HOWDY, the rule group for D would have been located and the process repeated for all the rules in that group, and then the Y group, if necessary.)

Final Comments

This project took me considerably more time and effort to produce than did the first Cheap-Talker project, but the rewards were greater. It is fascinating to be able to allow any program to generate understandable speech without having to maintain a high overhead in terms of memory. I think this project is more usable in diverse applications than the dictionary version described in my first article.

As I stated before, there are many ways to improve this project, but I hope I have been able to give ideas which will kindle the experimenter's spirit in you. Please drop me a note and let me know what you're up to, and if I can answer any questions not covered here (I'm sure there are some), let me know.

The programs described in this article are not listed here, of course, since the combined lengths of the algorithm and rules were pushing 8K bytes of memory. That's about 2200 lines of assembly listing, or 70 pages, which is a little too long to publish in a magazine article! If you wish to have the source code for everything described here, I will send it by mail for $25.00 ($26.50 for Californians, $30.00 for those outside of the US).

I will send you a DOS 3.3 disk which will include (1) object code for the driver and translator programs and the rules for use with systems with or without a 16K card (the disk automatically loads the appropriate code); (2) source code for the above software in LISA assembler format; (3) source text for the same in DOS 3.3 text files for conversion to other assemblers; (4) a small artificial intelligence/speech synthesis demonstration program in Basic, and (5) a small Basic program for testing the pronunciation capabilities of the translator.

If you do not own an Apple computer and would like just a source listing of the programs on paper, I can send that to you for $15.00 ($15.90 for Californians, $20.00 for those out of the country).

I hope this project will provide some useful ideas and enjoyment for you. Keep talkin'!■

References

1) H. S. Elovitz, R. W. Johnson, A. McHugh, and J. E. Shore, "Automatic Translation of English Text to Phonetics by Means of Letter to Sound Rules," United States Naval Research Laboratory Report 7948, 1976 (see Note).

2) Steve Ciarcia, "Build a Third-Generation Phonetic Speech Synthesizer," *Byte*, March, 1984, page 28.

3) Steve Ciarcia, "Build the Microvox Text-to-Speech Synthesizer," part 1, *Byte*, September, 1982, page 64; part 2, October, 1982, page 40.

Note: This document is available for $13.00 from the Sales Department, National Technical Information Service, 5285 Port Royal Rd., Springfield VA 22161. It should be ordered as item AD-AO21929. The price includes shipping. (Price and terms may change without notice.)

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Try an Inverted-Psi Wire

Get the DX edge on 80m with a radiation angle that's almost too low!

Capacitance hats have always appealed to me, especially with vertical antennas. I don't think we take enough advantage of these devices and this is particularly true at the lower-frequency bands such as 1.8 MHz and 3.5 MHz.

Some commercially-manufactured vertical antennas have capacitance hats, usually with a radius of less than 1 foot. This is much too small to have any effect except perhaps at 21 and 28 MHz. A capacitance hat can actually be quite large without producing any detrimental effect on the performance of an antenna; a 0.1-wavelength radius is quite practical.

This article describes the theory of operation of an antenna that I call the "inverted psi" because of its physical shape. The antenna uses a loading inductor and a large capacitance hat to provide low-angle radiation for DX on (in this case) the 80-meter band. The antenna is just 16 feet high, but it performs almost as well as a full-sized quarter-wavelength vertical.

Capacitive Loading

A capacitance hat at the end of any antenna will reduce the impedance at the end, raising it at the center. The larger the capacitance hat, the more pronounced this effect will be. If the capacitance hat is made too large, the current in the radiating portion of the antenna will drop too much and the low-angle radiation (in the case of a vertical antenna) will be impaired. But this does not happen to any significant extent until the radius of the capacitance hat exceeds 0.1 electrical wavelengths. At 3.5 MHz, this radius is more than 26 feet!

In general, the maximum allowable radius of a capacitance hat, designated by r and denoted in feet, is equal to 93.6/f, where f is the frequency in megahertz. Table 1 shows the maximum allowable radius of a capacitance hat for various amateur bands from 1.8 through 29.7 MHz, assuming we can get away with 0.1 wavelengths.

You will notice, no doubt, that no commercially-made antennas have capacitance hats this large.

Why use a capacitance hat with a vertical antenna? Because it greatly increases the effective height and improves the performance accordingly. This is not just theoretical speculation; it is a practical, useful fact. The performance of the inverted psi justifies this statement.

Because of geographical limitations I was able to use only two wires as the capacitance hat for my 80-meter vertical antenna. Ideally I would have employed four radial elements, but the antenna had to be put along the edge of a dock to take advantage of a salt-water ground plane. (If I had put any wires out into the water and the authorities had noticed, there would have been serious repercussions.)

Fig. 1 is a schematic illustration of the 80-meter inverted psi that I constructed. The vertical element is a little less than 16 feet high. The two capacitance-hat wires are about 22 feet long; this makes the antenna resonant at about 3.600 MHz.

The antenna is also resonant as a quarter-wave radiator at 14 MHz. The height of the vertical radiator was not chosen by accident. I like both 20 and 80 meters.

Antennas of this type can also be designed for 40 or 160 meters. Some years ago

Frequency (MHz)	Radius (Feet)
1.8 (band edge)	52.0
2.0 (band edge)	46.8
3.5 (band edge)	26.7
4.0 (band edge)	23.4
7.0 (band edge)	13.4
7.3 (band edge)	12.8
10.125 (band center)	9.24
14.0 (band edge)	6.69
14.35 (band edge)	6.52
18.118 (band center)*	5.17
21.225 (band center)	4.41
24.94 (band center)	3.75
28.85 (band center)	3.24

* Not authorized for use as of time of this writing.

Table 1. Maximum capacitance-hat radius for antennas according frequency, assuming 0.1 wavelengths as the largest tolerable.

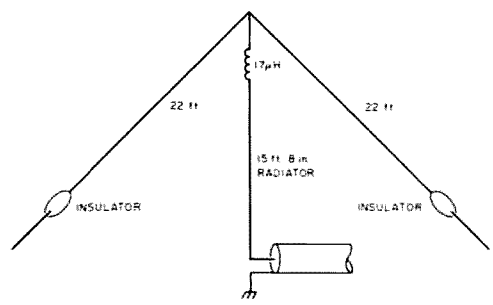


Fig. 1. Schematic illustration of the inverted-psi design for 80 meters.

I built a 10-foot version of this antenna for 40 meters and it worked very well, even with a marginal ground system. (I do not have the real estate to put up a 160-meter inverted psi—yet.)

Ideally, a capacitance hat would take the form of a solid metal disk at the top of a vertical radiator (Fig. 2). If the height of the vertical radiator is h feet and radius of the disk is r feet, then the effective height, h*, in feet, is approximately h + 2r.

That is the ideal case. The inverted psi is a little less than ideal, but the two 22-foot top-hat wires obviously increase the effective height by at least 22 feet. More probably (I didn't have an impedance bridge to precisely figure it out), the effective height is increased by about 1.5 × 22, or 33 feet. Along with the 16-foot radiator, that would result in an effective height of 16 + 33, or 49 feet. Almost a full-size quarter-wave vertical antenna!

The above is a little bit speculative. The real test of an antenna is not done on paper, but by putting it on the air and seeing how it works.

I built the antenna in a couple of hours one evening, had supper, fell asleep, woke up at 6:00 in the morning, turned on my receiver, and heard a ZL on 3.507 MHz. Promising.



Photo A. Top coil assembly for the inverted psi.

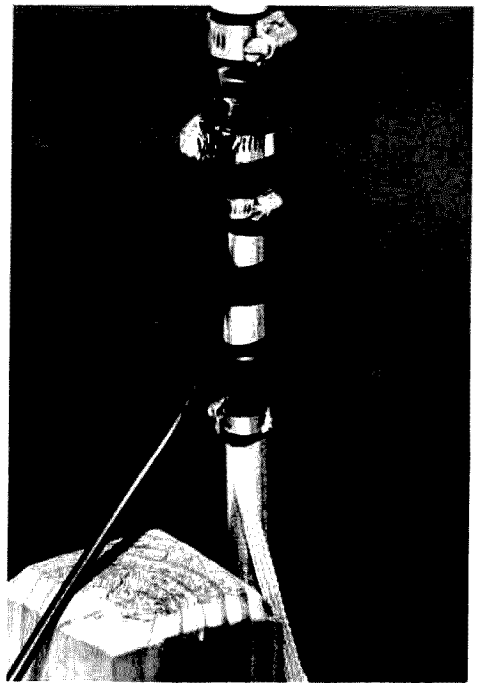


Photo B. This is the base assembly used at W1CV/4.

Grounding

A good ground system is essential for the performance of any ¼-wave antenna. An extensive radial system should be used. Ideally, this would consist of a metal plate having a radius of at least an electrical quarter wavelength and either buried just beneath or laid on top of the ground. I was fortunate enough to live in a place where this kind of "super ground" was almost provided to me by nature: I was staying in an oceanfront home. Salt water has conductivity many times that of even the best earth.

I used two 30-foot lengths of tinned ground braid immersed in the salt water and running outward from the antenna base in opposite directions (Fig. 3). The tinned braid would not corrode as quickly as plain copper, I figured. This proved to be true. The braid was about 1 cm in width, and this provided good contact with the salt water. A massive radial system was not used and, as it turned out, the antenna worked very well simply because of the salt water. If you don't have access to a salt-water ground, however, I would recommend that you install as many radials as possible, making them all as long as possible.

Construction of the Top Loading Apparatus

I used a loading coil at the top of the antenna in conjunction with the two 22-foot capacitance-hat wires. It occurred to me that I could use a toroidal loading coil. I obtained a Palomar Engineers T-200-2 powdered-iron toroid core and wound 38 turns of heavy, insulated wire on it, obtaining an inductance of 17 uH. (This value was determined by experiment, but I will spare you the details of the painful story: "Put it up, take it down, cut a few turns off, put it up, take it down. . .")

Being sure that the toroi-

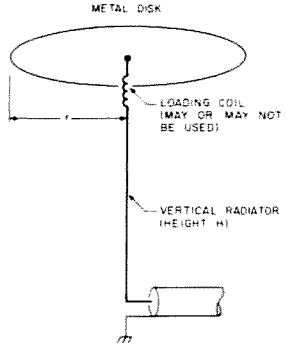


Fig. 2. Ideally, a capacitance hat would take the form of a solid metal disk at the top of a quarter-wave radiator.

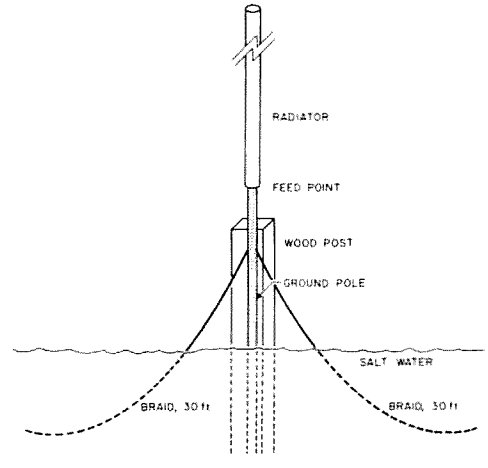


Fig. 3. Grounding scheme used at W1CV/4. The salt water proved to be an excellent ground plane.

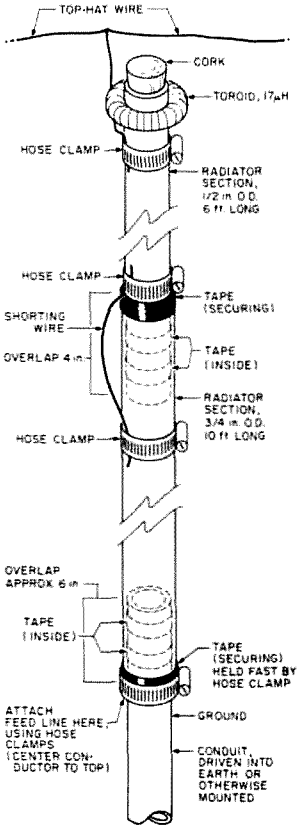


Fig. 4. Diagram of antenna construction, including base assembly. The center conductor of the feedline is connected to the bottom of the 10' section of ¾" conduit. The coax braid is connected to the top of the lower ½"-o.d. section.

dal coil was large enough to fit around the vertical radiator section (which was ½" o.d.), I placed it there and secured it with electrical tape (Photo A). The two 22-foot capacitance-hat wires, made from uninsulated AWG no. 22 tinned copper wire, were soldered to one end of the coil. The other end was wrapped with electrical tape and secured to the vertical radiator with a hose clamp.

It is important that the coil be kept in place and prevented from sliding down the radiating element. The hose clamp would be adequate for this (see Photo A), but I put a little extra tape around the vertical radiator for good measure. (You will notice from the photo that I also wrapped the toroidal inductor with tape. This isn't really necessary. I guess I have a certain fondness for black plastic tape.)

Frequency (MHz)	Swr
3.500	2.0
3.525	1.8
3.550	1.7
3.575	1.5
3.600	1.4
3.625	1.4
3.650	1.5
3.675	1.6
3.700	1.9
3.725	2.1
3.750	2.3

Table 2. Measured swr values for the 80-meter inverted psi at W1GV/4. Center frequency was approximately 3.600 MHz.

The toroidal inductor might not handle the maximum legal power limit. I don't know how much power it will take, although I am reasonably sure it will work with several hundred Watts. I tested this antenna (and used it for general operation) with only 20 Watts of rf output. Another of my loves is QRP. (Do I hear someone saying 20 Watts is *QRO*?)

Construction

The parts list shows what was needed for the construction of the inverted psi for 20 and 80 meters at W1GV/4. I won't go into a lot of detail regarding the construction since you can probably figure out how to put up a 16-foot vertical. The important consideration is the base mount: It must provide good insulation along with mechanical strength.

I did not happen to have a ready-made base mount, so I was forced to construct a home-brew one. The lower section of steel conduit, measuring ¾ of an inch in diameter, was slipped over a ½-inch section of conduit which had been wrapped with some plastic tape to provide insulation as well as a tight fit. The ½-inch section of tubing was attached to one of the posts of the dock and rested on the bottom of the canal in front of the house. Photo B shows the base mount including the coaxial feedline.

Fig. 4 shows schematically how the base mount was put together. The conduit could be driven into the ground, attached to a fence post, or anchored down in any other reasonable way. The main consideration is that the base of the antenna be reasonably close to the ground—within a few feet, at most, of the radial system or other ground plane.

Mechanical strength is also important with the base mount. I used steel conduit (not aluminum tubing) for this antenna because I couldn't find any aluminum tubing at local hardware stores. This proved to be a good thing, however, since the Florida Keys can get quite windy (55 knots is not unusual) and I was not able to guy this antenna because of its location. The antenna withstood 55-knot winds without incident. For extra strength, you might want to guy the antenna from the top with two pieces of twine or nylon cord in addition to the two top-hat wires. A well-guyed antenna of this kind would probably withstand hurricane-force winds, unless struck by a falling tree branch or other windblown object.

Base-mount capacitance is not especially important since the feedpoint impedance of this antenna is relatively low. Several inches of overlap can be tolerated. It is important only that water be kept out of the antenna. This is ensured by plugging up the top of the vertical element with a cork, rubber stopper, plastic tape, or some other waterproof substance.

Tuning

This antenna will not function over the entire 80m band since it is an inductively-loaded antenna and is physically shortened. Besides, the 80-meter band is, in terms of percentage, the widest of our high-frequency bands, and even a full-sized antenna won't display a low standing-wave ratio (swr) over the whole range of frequencies.

The inverted psi, given a good ground plane, should have a 2:1 swr bandwidth of 150 to 250 kHz. Table 2 shows measured swr values at W1GV/4, using RG-58/U coaxial-cable (52-Ohm) feedline. The center frequency was chosen by trimming the two top-hat wires a few inches at a time. Naturally, I started out by trimming off way too much wire and had to splice some back on (Murphy 344:24-26). *Note*: It is not imperative that the two top-hat wires be exactly the same length. A small difference will not have any effect on antenna performance.

The top-hat wires can be brought down at any angle greater than about 45 degrees with respect to the vertical radiator. At W1GV/4, the angle was about 60 degrees. You can run them out horizontally if you wish, but don't bring them down at any angle sharper than that at which the ends of the top-hat wires nearly touch the ground—that's about 45 degrees—and do not electrically connect the ends of the wires to anything metallic! The swr curve as well as the center frequency of the antenna will depend to some extent on the angle at which the wires are brought down. The bandwidth will also be affected somewhat: The larger the angle (the more nearly horizontal the wires), the greater the bandwidth.

The information in Table 2 was obtained at W1GV/4 with an intended center frequency of 3.600 MHz, roughly in the middle of the CW/RTTY/AMTOR band.

Don't expect your swr curve to be *identical* with that in the table even if you happen to choose the same center frequency. But if you get results that are *dramatically* different, say, a minimum swr of 4:1 or a bandwidth of only 20 kHz, then something is wrong and you should recheck your installation.

Performance

After the tuning and swr-checking phase, it was finally time to start operating with the inverted psi. As I said, I did some casual listening at first and heard a ZL near the bottom of the band. I hadn't ever heard a ZL on 80 meters before, although I must confess I hadn't ever tried that hard for DX on this band. I tried to call him with my 20-Watt output, but to my dismay I noticed that I had neglected to plug my keyboard into the transmitter (Murphy 345:7-8). By the time I had yanked the transmitter off the shelf and plugged the keyboard in, the ZL was gone (Murphy 345:9). But other opportunities would come up.

Several fairly distant stations were worked with good reports. A VE1 gave me a 589; he was in a direction almost opposite the salt-water ground plane. Numerous stateside and VE stations were contacted with ease, and they gave me reports that, in most cases, were as good as or better than those I gave them. (I admit to being stingy: "Good signals" are, I think, S6, right?)

I did not run more than 20 Watts of rf output at any time while using this antenna. For one thing, I had modified my transmitter so that I couldn't even if I was tempted; secondly, as I've said, I like QRP. And there is another thing. I have a terrible fear of potential TVI/RFI victims who swear a lot and who own guns.

The antenna worked quite well on 20 meters, not to my surprise since it is a full-sized quarter-wave radiator there. If you plan to use this antenna on 14 MHz, you should put the base mount as close to the ground plane as you can manage. In my case, it was 3 to 5 feet above the level of the salt water (depending on the tide), and hence the swr was rather high—the resonant frequency being below the bottom of the band and, moreover, the swr varied as the tide went in and out. Still, worldwide DX was no problem. The antenna would no doubt have worked even better at 14 MHz if I had made it a little shorter to compensate for the elevation of the base. ■

Parts List

2	Steel conduit or aluminum tubing, ½" o.d., 10 ft. long*
1	Steel conduit or aluminum tubing, ¾" o.d., 10 ft. long
1	Toroid core, powdered-iron, Palomar Engineers T-200-2 or equivalent, wound for 17-uH inductance
2	22-foot lengths of wire, type not critical, AWG no. 22 to 18
2	Insulators for ends of top-hat wires
10	Hose clamps (you can never have too many of these), 1" diameter.
1	Roll of electrical tape
1	Base-mount apparatus, constructed to your own taste
1	Cork for top of antenna
1	Length of coaxial cable, 50-Ohm preferred
1	Roll of strong twine or nylon cord for securing top-hat wires
1	Long roll of wire for radial system (if ground mount used)
1	Ground rod (if earth ground used)
1	Roll of heavy ground braid (if salt-water ground used)
1	Standard tool kit

*One of which is cut to 6-foot length



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The majority of hams have been exposed to the popular VHF/UHF FM equipment on the market today. If you've purchased any, you'll more than likely choose to have the touchtone™ pad as part of the equipment. Most of us think of the pad as an important part of the two-meter environment because of the frequent availability of autopatch.

However, there are many other uses for the touchtone pad. One that has been of great interest to me is what is commonly referred to as Selcal (selective calling). We have several repeaters in Oregon (which are on high mountains) with wide coverage and high traffic. I frequently like to listen to these repeaters for calls coming my way, but don't like all the chatter hour after hour. Selcal will give me the quiet I want without missing calls.

Here's how it works: The receiving station has its audio output interrupted by a circuit which must sense a unique sequence of touchtones sent from the transmitter before it reconnects the audio to the loudspeaker. Whoever is calling at the transmitter must send this code before making a voice call. The specific circuit that senses these tones is called a dual-tone multiple-frequency decoder (DTMF). ("DTMF" is the more technical definition of the touchtone signals.)

The integrated circuits that do this task are very popular in the telephony business; they are the same circuits used to sense the dialing of your modern telephone. DTMF was cleverly designed so that it minimizes the chance of voice operation "tripping" the circuit. It works on the principle of sending two very precise audio tones over the circuit at the same time. The specifications of these tones are held to tight tolerances.

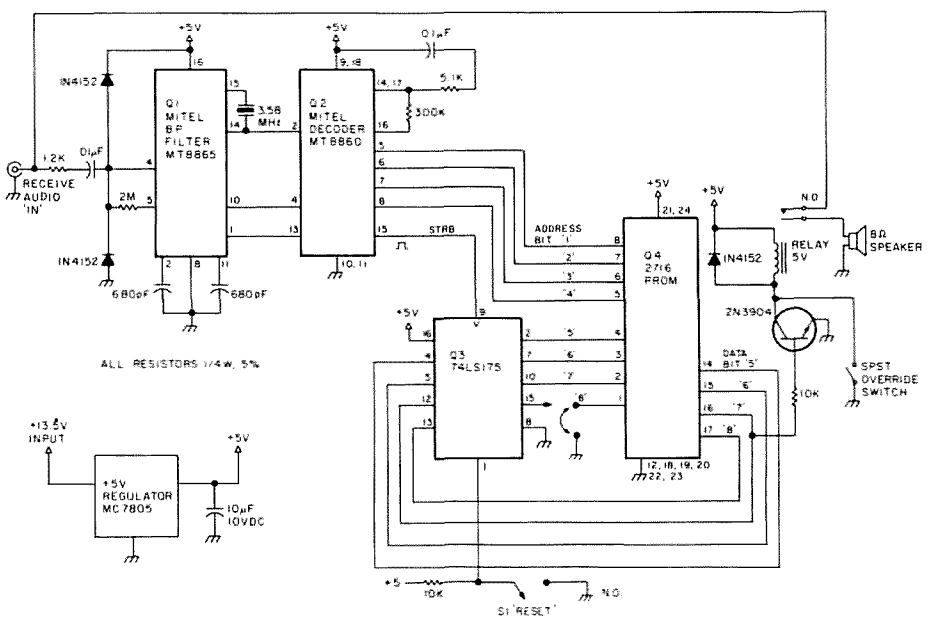


Fig. 1. Selcal schematic.

If you wish to monitor a frequency, then you need to place a decoder on the speaker output of your VHF/UHF rig along with a sequence decoder that detects the proper (secret) keying sequence. An outboard speaker is then wired so that only when the correct sequence is received does it get connected to the receiver audio. All stations calling for you must use the previously-defined sequence to enable your equipment and turn on the speaker.

Once you are done with the contact, you place the decoder in service again and the speaker is disconnected so that you remove all further audio. It's a great way to make life a little easier when you must monitor a repeater. It's great for husband and wife teams (my XYL is a ham), as you can keep in touch throughout the day. It can also be handy for emergency service teams. You can use the Selcal concept to call all the members in time of need using one common Selcal code sequence.

Another frequent use of the touchtone pad is for power-controlling purposes. You may use a sequence of DTMF tones to control any number of electrical devices in your ham shack or elsewhere. We truly have a very powerful tool on the front of our VHF/UHF hand-helds and mobile rigs. The controlling capability is already built into the rig; all we have to do is put it to use. If you let your imagination run wild, it's amazing what you can dream up as possible applications, but in order to keep this article short I will concentrate only on the implementation of Selcal.

DTMF Decoder

The first thing needed in implementing a system is a method of decoding the DTMF signals at the receiver audio. That is relatively easy today. We have modern VLSI integrated circuits which will do the job superbly. Several vendors have them on the market. The one used here is a set of two chips, Mitel MT8865 and MT8860. The first is a DTMF filter and the second is the actual decoder. Mitel informs me that this chip pair now sells for $28.00 in single-unit quantities. They also have a single-chip version.

DTMF Character	Binary Output
D	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
0	1010
*	1011
#	1100
A	1101
B	1110
C	1111

Table 1. Logic of simple state machine.

The schematic of how they are connected is shown in Fig. 1. The output of Q2 is a simple 4-bit binary data word plus a strobe pulse. The strobe, pin 15, tells the remaining circuitry that it has received a valid DTMF signal and it has lasted long enough to ensure that it is not just random noise. You will notice in Table 1 the binary code that represents each of the unique DTMF codes. This particular chip set decodes all 16 of the tones. Many ham rigs have provision for sending only 12 codes; they leave off the codes for A, B, C, and D. As a result of these chips, we have converted the tones received into a 4-bit binary number. Not very complicated, is it?

Selcal Security

To make a Selcal system secure, it is a good idea to have a long sequence of characters to enable your system. I use a series of four which gives a unique pattern that would occur randomly only once in 65,536 tries. If someone wanted to find out what code I'm using, it would be easier for them to buy a chip set and decode it off the air directly. Also, by having several characters to enable the system, the probability of false triggering through voice patterns or noise is greatly reduced.

In the example, I use an enable sequence of 2-5-8-0 and a disable sequence of 5-6-6. The normal method of decoding a sequence is to use combinational or conventional logic. This usually takes the form of a digital comparator, a shift register, and a matrix of switches to set the code required for matching. This requires a fair amount of circuitry, particularly when you have to decode seven characters as mentioned above. An elegant method of doing this is called a "state machine" and offers some interesting advantages. First, the state machine is implemented with only two off-the-shelf low-cost integrated circuits. Many sequences can be decoded—far more than described here—with no additional circuitry.

GOAL

IF—
Input 1 goes high (logic 1) first and it is followed by input 2 going high while 1 remains high,
THEN—
Enable output high for one clock cycle

Address	Data Out	
0000	00	State 1 (reset state)
0001	01	
0010	00	
0011	00	
0100	00	State 2
0101	00	
0110	00	
0111	10	
1000	00	State 3
1001	00	
1010	00	
1011	00	

Table 2. Mitel MT8860 decoder output.

State Machine

The idea behind the state machine needs a little study for those who have worked only with combinational logic. First, most state machines are implemented with just two components: a PROM (Programmable Read Only Memory) and a set of type-D flip-flops. They work on the principle of establishing well-defined states for the logic. The states will progress from one to the next based upon the program that has been burned into

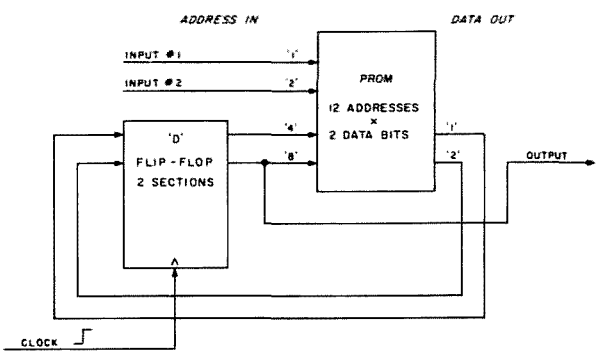


Fig. 2. The simple "state machine."

the PROM, the clocking signal, and the state of the input signals. The idea is well known to people who design microprocessors or other fast sequential logic but is unknown to most electronics experimenters.

To explain how a simple state machine works, let's refer to Fig. 2 and Table 2. First, assume that we have the design task of implementing the logic statement (goal) outlined in the table. Notice that this is not a simple AND gate; it demands that the sequence of input 1 precede 2 by an undetermined amount. Also, be aware that this logic is clocked rather than dc in nature. For anything to happen, the clock pulse must occur.

From this point on, it is important to abandon the idea that the clock must be a periodic signal. Rather, it will be the signal from our DTMF decoder that tells us that a valid code has been received. This is an important characteristic that makes a state machine a good way of implementing a Selcal circuit. The state machine advances only after we press a touchtone key at the transmitter. From a timing point of view, it will be random.

Now assume that we have programmed our 12-address-by-2-bit PROM with the code shown in the Table 2 truth table. The reason for this particular code will become obvious shortly. We will start with the output of the two type-D flip-flops in the logic 0 state. Notice that the output of the flip-flops drives the two most-significant bits of the address to the PROM. Therefore, the only possible addresses that the PROM could take would be between 0000-0011 binary, or what is shown as state 1 in the table.

The lower most-significant bits of the PROM address are tied to inputs 1 and 2. Hence, the state of the input signals controls, in part,

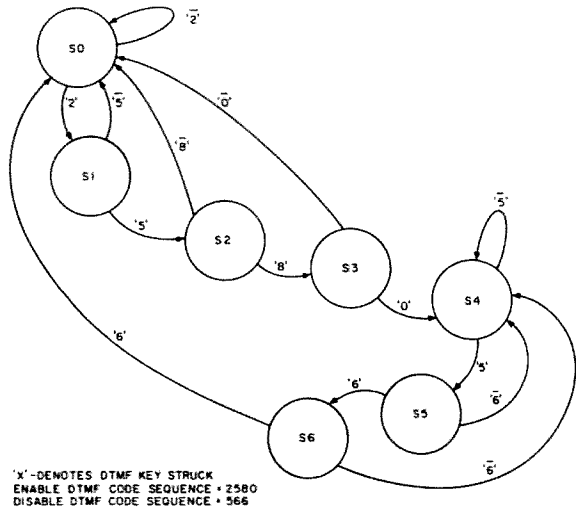


Fig. 3. Selcal state program.

the PROM address. If the states of the inputs are both low, the effective address of the PROM will be 0000. Now notice that the data word out of the PROM for that address is 00. In addition, the output of the PROM is also fed back to the input of the D flip-flops so that when a positive transition of the clock pulse occurs, the two most-significant bits of the PROM address will be updated.

In the example so far, they will be updated to 00 since that was the output of the PROM just before the clock pulse. The effective address of the PROM remains 0000. We also can say that the device remains in state 1. Now let's change input 1 to logic 1. The effective address is now 0001, but notice that the data word is now 01. If a clock pulse occurs at this time, the new effective address will become 0101 and we will jump into state 2 on the diagram.

Next, let's assume that input 2 goes high. The effective address becomes 0111. The data word is 10. If a clock pulse now occurs, we will jump to state 3. While the device is in state 3, the most-significant bit of the address is set high. We can use this bit as an output to solve our logic equation. Notice that it remains high until the next clock, which then will drive the circuit back to state 1 in all cases since the data word is 00 for every condition of the input lines. The next effective address must be somewhere in state 1.

Now we'll go back to state 2 and see what would happen if input 2 didn't go high during this state. The effective address would be 0101 and the data word would be 00. The next clock pulse would load the flip-flops with 00 which would, of course, drive the most-significant address bits back to the state 1 condition. We see that the logic was not satisfied and the output was never driven to state 3. It should now be clear that to get an output-high condition, the proper sequence of events in this particular goal statement must be satisfied. If they are not, the logic forces you to keep jumping back to the reset state—state 1.

Many variations of these concepts exist. It is suggested that the reference at the end be used if you wish further information. One common difference that you find on most state machines is that the output usually is taken from the data word directly. In this example, it's easier to take it from the flip-flops. Most machines are based on this simple idea of a PROM and D flip-flops. The great advantage is the simplicity of the hardware and thus the very low cost.

Selcal or Bust

Now that we have the foundation of the concepts, let's put it to practical use. Suppose that we want to build a Selcal circuit that will activate our receiver speaker whenever the DTMF sequence of 2-5-8-0 is received and will disable it when 5-6-6 is received. We will use a 2716 PROM (UV erasable) which can be purchased for $2.95, plus a 74LS175 quad-D flip-flop which is about $0.75. See Fig. 1. The PROM is very popular with the computer hobbyist and has a configuration of 2048 addresses by 8 bits. We will use it as if it really were only 128 addresses by 4 bits. We have far more capability in this device than we need, but on the other hand it's cheap and we may want to expand our circuit with more exotic capabilities at a later date. A great place for experimentation.

The state machine is driven by the Mitel MT8860—Q2 in Fig. 1. The output of this chip follows the truth table in Table 1. These four bits will be used as the four least-significant address bits of the PROM. The next three most-significant bits will be derived from the output of the D flip-flops (3 each). The inputs to the flip-flops result from bits 5, 6, and 7 out of the PROM data word. Bit 8 is also routed to one of the flip-flops in Q3 but is used for future expansion only. Data output bits 1-4 will not be used and are not shown. (They could be used as outputs if desired.)

Earlier, I mentioned that the clock to a state machine may be from a random event. Here we'll derive the clock from the strobe command out of Q2. This signal goes high when a valid DTMF tone has been de-

tected, so it may be somewhat random. The relay to connect the loudspeaker is driven off bit 7 of the data word. The entire circuit including the DTMF decoder requires only four integrated circuits.

The first step in programming the PROM is to introduce the concept of the "state diagram." This is shown in Fig. 3. It is much like a flowchart, but we specifically refer to each condition as a "state" or address subsection in the PROM. It is an excellent diagram to show what happens when an invalid code is received.

State 0 (S0) is the reset state. The only way to advance to state 1 (S1) is to receive a 2 in the DTMF code. Once in state 1, you must receive a DTMF 5 code to advance to state 2, etc. Notice what happens if you are in state 1 and something other than DTMF 5 is received: You resort back to state 0. By studying this diagram, you will see that the only code sequence that will allow you to advance to state 4 will be 2-5-8-0.

State 4 is the address range, $40-4F (a $ ahead of a number means it is in hexadecimal). Bit 7 is used as an output, hence the speaker is turned on. In fact, it will remain on until the 5-6 sequence occurs, and will be unconditionally off after the 5-6-6 sequence and the state diagram shows a return to state 0. The PROM program is shown in the PROM program listing. To change to some other sequence you need only change the program.

The listing is shown in hexadecimal. The PROM was programmed using an assembler on the Apple II computer. With only 128 addresses needed, it could be done manually. The computer is handy, as it makes the programming very simple. If you don't have a PROM burner in your ham shack, locate a fellow ham who is into both ham radio and computers. More than likely it won't take long to find someone who can help. Also try the local computer club.

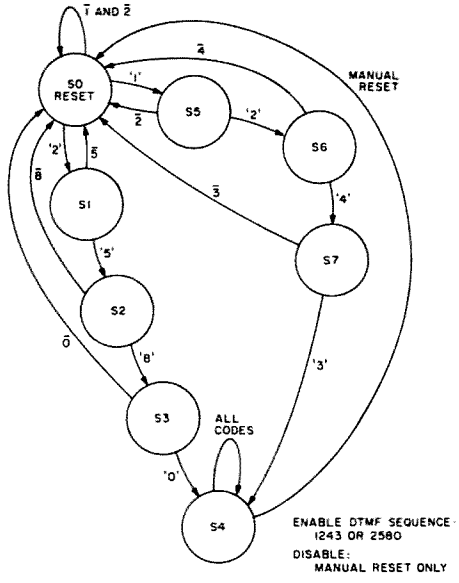


Fig. 4. Dual-sequence Selcal.

The actual hexadecimal addresses are located on the left-hand side of the listing. Notice the state labels, S0, S1, S2, etc., after the line numbers. They point to the beginning of the address group that represents that particular state. Since IC Q2 determines the lowest 4 bits of the effective PROM address, each state will have a total of 16 possible addresses. One of the data words in each group of 16 will point to the beginning of the next state if that particular effective address is chosen.

For example, assume you are resting in state 1, and Q2 sends a 0001 to the PROM. This is the equivalent to a DTMF 1 from Table 1. The effective address will now be $11. This is true because Q3 must be statically holding a $01 (to force it to state 1) plus the 0001 code from Q2. Location $11 produces, from the listing, a data word of $00. When the next clock pulse occurs from pin 15 of Q2 (which means a valid DTMF tone is received), a $00 will be loaded into Q3 and the PROM address range will return to the state 0 address range.

Now let's go back again and assume we are currently resting in state 1 and this time a DTMF 5 occurs. This puts 0101 into the lower 4 bits of the PROM and makes the effective address $15. Now, at the time of pin 15 strobe, the data word of $20 will be presented to Q3 and the machine will go into state 2. We are hence progressing down the state diagram in Fig. 3 to solve for the unique combination of 2-5-8-0.

You will notice that once you get to state 4, bit 7 of the data word will be high. With bit 7 connected to the base resistor of the 2N3904, the relay will be enabled. This relay controls the speaker. The relay will remain enabled until the unit is either manually reset by pressing push-button S1 or by sending the reset code which will cause the machine to progress to S5, S6, and a return to S0.

A word about state 7 is needed. You'll notice on the state diagram that we never call the state 7—so why was it coded into the PROM? The PROM is hard-wired so that addressing bits 9, 10, and 11 are held at logic 0. That restricts the possible addressing range to the lowest 128 addresses, which is $7F in hexadecimal. When power is applied, we want to be sure that the machine comes up in a recoverable state. S7 is a possible power-up state since it is in the possible address range. When in S7, Q3 will force the PROM into S0 the next time a signal comes from pin 15 of Q2. Likewise all other states can be shown to be recoverable.

Another way would be to cause a reset to Q3 upon power-up. This would always guarantee that state 0 was reached, but without state 7 there is still the possibility of a lockup. The best solution is to use both. I didn't incorporate an auto-power-up reset in the circuit since it self-recovers if you have a power failure. The manual reset push-button, S1, is used for local reset in the event the caller did not send the reset sequence, 5-6-6.

Notice the jumper at pin 15 of Q3. In this example, the Q4 address bit 8 is grounded rather than being connected to pin 15. This restricts the address range as mentioned above to 128. When this jumper is connected to extend the addressing range to 256, it represents the latched 8th bit of the data word. It could be used for an additional control circuit. In addition, the lower 4 bits of the Q4 data word serve no purpose in this design, but could easily be used for additional control circuits. With Q3 being four bits wide, and Q2 supplying four bits, the maximum address range is 256.

The PROM has a capacity of 2048. To extend the useful range to its maximum capability, some additional storage registers are needed. This could be done by adding another 74LS175 or by feeding some of the data bits back into the addressing lines. That is beyond the scope of this introductory article.

```
                    1    */DTMF STATE MACHINE PROM PROGRAM #V2.0-N. ROBIN, WA7NBF
                    2    *
                    3    *THE MITEL DTMF DECODER GIVES OUTPUTS FOR THE
                    4    *FOLLOWING SEQUENCE OF DTMF TONES--
                    5    *D,1,2,3,4,5,6,7,8,9,0,*,#,A,B,C
                    6    *WHICH REPRESENTS $0-$F AS SEQUENTIAL BINARY ADDRESSES
                    7    *
                    8              ORG   $0000
                    9    *
0000: 00 00 10
0003: 00 00 00
0006: 00 00         10   S0        HEX   00,00,10,00,00,00,00,00
0008: 00 00 00
000B: 00 00 00
000E: 00 00         11             HEX   00,00,00,00,00,00,00,00
0010: 00 00 00
0013: 00 00 20
0016: 00 00         12   S1        HEX   00,00,00,00,00,20,00,00
0018: 00 00 00
001B: 00 00 00
001E: 00 00         13             HEX   00,00,00,00,00,00,00,00
0020: 00 00 00
0023: 00 00 00
0026: 00 00         14   S2        HEX   00,00,00,00,00,00,00,00
0028: 30 00 00
002B: 00 00 00
002E: 00 00         15             HEX   30,00,00,00,00,00,00,00
0030: 00 00 00
0033: 00 00 00
0036: 00 00         16   S3        HEX   00,00,00,00,00,00,00,00
0038: 00 00 40
003B: 00 00 00
003E: 00 00         17             HEX   00,00,40,00,00,00,00,00
0040: 40 40 40
0043: 40 40 50
0046: 40 40         18   S4        HEX   40,40,40,40,40,50,40,40
0048: 40 40 40
004B: 40 40 40
004E: 40 40         19             HEX   40,40,40,40,40,40,40,40
0050: 40 40 40
0053: 40 40 40
0056: 60 40         20   S5        HEX   40,40,40,40,40,40,60,40
0058: 40 40 40
005B: 40 40 40
005E: 40 40         21             HEX   40,40,40,40,40,40,40,40
0060: 40 40 40
0063: 40 40 40
0066: 00 40         22   S6        HEX   40,40,40,40,40,40,00,40
0068: 40 40 40
006B: 40 40 40
006E: 40 40         23             HEX   40,40,40,40,40,40,40,40
                    24   *
                    25   *STATE S7 IS NOT USED BUT STILL MUST BE INCLUDED FOR
                    26   *POWER UP INITIALIZING.
0070: 00 00 00
0073: 00 00 00
0076: 00 00         27   S7        HEX   00,00,00,00,00,00,00,00
0078: 00 00 00
007B: 00 00 00
007E: 00 00         28             HEX   00,00,00,00,00,00,00,00
```

PROM program listing

Construction

The crystal shown in the diagram for Q1 is a standard low-cost TV sub-carrier type. The ICs use different sockets: two with 16 pins, one with 18 pins, and one with 24 pins for the 2716. All of these parts should be easy to obtain by mail order or any store that caters to the computer hobbyist. The silicon diodes can be any general-purpose small-signal type, and the capacitors are not critical.

The relay was found in my junk box, but any type that is compatible with the power supply and the driver transistor will work. The actual circuitry uses only +5 volts. Since my receiver runs off +13.5 volts, I chose to power the unit with a packaged +5-volt regulator, the MC7805C. It costs about $0.95. The layout is noncritical, but some care should be taken to avoid static in handling the IC devices. It is recommended that a metal box be used for an enclosure since strong rf fields in the immediate vicinity can cause erratic operation. Use shielded audio input lines, and be sure that the power leads have rf bypassing.

Although this unit uses only four ICs, Mitel now has a single-chip DTMF decoder, the MT8870, which sells for about $20.00 and could reduce the count to three devices. I've not experimented with it. (The West Coast sales office can be reached at (408)-249-2111.)

Emergency Calling

An important additional feature that could be designed into the PROM program is a dual-access code. The first would be your own private sequence such as 2-5-8-0, and the second would be common to all your members, say 1-2-4-3. Fig. 4 shows the state diagram of this hypothetical example. Whenever a sequence of 1-2-4-3 is received, all members of your organization would have their Selcal circuit activated. Whenever the 2-5-8-0 is sent, you would be the only one to have your system enabled. This is a powerful way to organize an emergency services net, for example. Reset would occur manually.

Disadvantages

Although the state machine is very cheap to reproduce, it suffers when you change to a new coding sequence since you must burn a new PROM. I personally don't consider this a problem because I have equipment handy to do the job. Many people may not. At first you may think of it as complicated, but it just takes getting used to thinking in terms of state-machine implementations instead of conventional logic. You'll be happy later because of simpler circuits and greater reliability. The state machine is more familiar to computer types rather than old-time rf guys, but on the other hand, this may be a good way to learn.

Operation

A few things have been noted in the use of the circuit. First, it's always a good idea to start the DTMF sequence with some unused key. In the above example, this could be "#". The sequence then would be: #-2-5-8-0. The reason is that noise may have taken the state machine to state 1 or 2. Any non-valid key will drive the state back to 0. From that point on, you know the proper sequence to follow. This helps ensure that you start out in a reset state.

The second observation is that if you have reached state 4, you cannot get back



to state 0 without sending cancel code 5-6-6 or hitting the reset push-button. Here again, use an unused key first before you send the 5-6-6, e.g., #-5-6-6. This will force the machine back to state 4 before you send the correct sequence to reset the circuit.

If you intend to use this device through a repeater, be sure to get permission from the control operator. Give him your access code, out of courtesy. If he's aware of the code you're using he can tell you if you have selected any sequence that could cause problems with the repeater-control system. This is particularly true when using a random reset code. One that I always try to avoid is the "*". Many repeaters begin their autopatch operation with an asterisk.

I've checked with the FCC as to the acceptability of using the described concept and they see no problem. If you're considering using the DTMF tones for controlling electrical circuits, check with the amateur rules as to acceptance.

Another operational approach seems to be to leave the squelch open when the Selcal is enabled so that when you do hear the receiver hissing noise, even if you were out of the room, you know that someone has tried to call. When you attach the Selcal to your rig, the local built-in speaker should automatically be disconnected. All rigs I've seen work in this fashion so you shouldn't have any modifications to make to your radio equipment.

There are many variations to the above circuit. Let your imagination flow and let me know all the good ideas that result. Happy Selcalling! ■

Reference: *Designing Logic Systems Using State Machines*, Christopher R. Claire, McGraw-Hill Book Co.

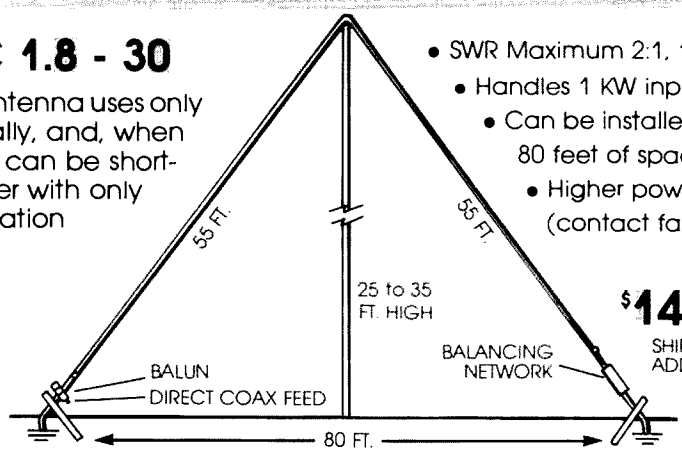
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A new electronic technology is emerging in many laboratories around the world. This new technology, superconducting electronics, is as different from semiconductors as the now vanishing technology of vacuum tubes. Superconducting electronics is made possible by a number of unusual conditions that may occur in electronic circuits when they are cooled to extremely low temperatures.

A number of metals and alloys lose all resistance to electric currents at temperatures a few degrees above absolute zero (−273° C). In a superconducting circuit, a current can be maintained almost indefinitely once started. Alternating currents may still experience some impedance at superconducting temperatures, but these impedances are very low compared to those that are encountered in conventional circuits.

Not only temperature, but magnetic fields and current density also determine a material's ability to become superconducting. As current densities increase, a material becomes more susceptible to the squelching of superconductivity which can be caused by a magnetic field. Increasing current densities and magnetic-field strength also reduces the temperature at which a certain material will become superconducting.

An extremely small particle may appear to have passed through a barrier without punching a hole in it. This phenomenon is called tunneling. For the electron, tunneling is possible provided that the barrier is less than a few hundred atomic diameters wide. A thin film of isolating material between two films of conducting material is a tunnel junction. At room temperatures, a tunnel junction may show a resistance of several hundred Ohms.

In 1962, an English scientist, Brian Josephson, predicted the behavior of a tunnel junction at extremely low temperatures. He believed that at superconducting temperatures, the tunnel junction itself would become superconducting. In this condition, no resistance or voltage could be measured across the junction. Brian Josephson predicted that a small magnetic field could turn the superconducting tunnel junction back to its resistive state. He also predicted that the superconducting tunnel junction would return to its resistive state if the current rose above a certain value, which he called the critical current.

The superconducting tunnel junction could thus be switched back and forth between its superconducting and resistive states by controlling the current through a small loop of conducting material near the tunnel junction. This control current would cause a magnetic field ex-

Photos courtesy of IBM

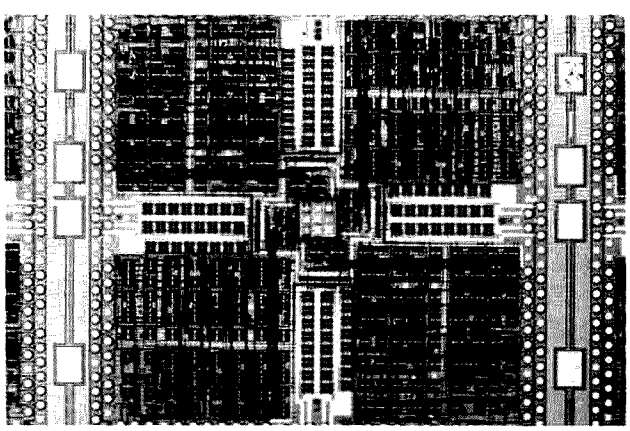


Photo A. An experimental Josephson circuit chip, made at IBM's Thomas J. Watson Research Center in Yorktown Heights NY. The chip contains 300 Josephson-Junction logic circuits and their power supplies. The overall power dissipation of this chip is only a few milliwatts.

ceeding the value which the superconducting junction would tolerate whenever the junction was to return to its resistive state. This new electronic device was soon observed in the laboratory and was named the Josephson Junction, after its discoverer. In 1973, Brian Josephson, together with two other pioneers in superconducting electronics, Leo Isaki and Ivar Giaver, received a Nobel prize in physics.

The Josephson Junction has several remarkable properties which make it an attractive component in super-fast computers. A Josephson Junction can switch its state faster than any other electronic component. The fastest Josephson Junctions have been observed to have switching speeds around 10 picoseconds. This corresponds to a frequency of 100 gigahertz.

Very fast computers must also be very compact in order to reduce the time which is required for a signal to move from one part of the computer to another. Each component in a super fast computer develops heat that must be dissipated. There are limitations to the amount of heat that can be dissipated from a small space, so a super fast computer with too many components in a small space could literally melt itself. The power consumption of a Josephson Junction is only about one thousandth of that of comparable semiconductor devices. The amount of heat which would have to be dissipated from a super fast computer using Josephson Junctions is, therefore, much easier to manage than the heat from a comparable semiconductor computer. The extremely low impedance which is encountered in superconducting wires and transmission lines is also making this technology attractive for super fast computers.

The Josephson Junction can be used as a voltage-controlled oscillator. If a voltage is established across a Josephson Junction, an alternating current will appear. The frequency of this alternating current is voltage dependent. The maximum frequency of such oscillators is far into the microwave region. This effect will also work in reverse. If an alternating current is coupled across a Josephson Junction, a voltage will appear that is proportional to the frequency of the alternating current. The output of a Josephson-Junction vco is of very low amplitude and would need a great deal of amplification before it could be used in most analog applications.

The Josephson Junction is more sensitive to magnetic fields than any other device. This led to the first commercial application of the technology. Magnetometers using these junctions have been on the market for several years.

A Josephson Junction is a latching device. Once it has changed state, it will remain in that state until the current through the junction is interrupted. But in contrast to semiconductors, Josephson Junctions work equally well with currents of either polarity. By using an alternating current as power supply, the latching effect can be cancelled. Each time the ac crosses zero, the Josephson Junction returns to its original state. In a computer circuit using Josephson-Junction technology, the alternating current which supplies the power to the junctions can also serve as the clock of the computer.

A new superconducting electronic device was presented by its inventor, Dr. Sadeg M. Faris of IBM, in January of 1983. This device, which is similar to the transistor in semiconductor technology, is called a quiteron. The quiteron uses two tunnel junctions and consists of three thin films of conducting material which are separated by two even thinner barriers of insulating material. A small change in the current between two of the conducting films will result in a large change in the output voltage from the quiteron circuit. So far, quiteron amplifiers have shown a power gain of only 10, but the gain figure is expected to improve as these circuits become more refined. The quiteron is very fast, like the Josephson Junction, and is capable of processing signals into the gigahertz range. The power dissipation of a quiteron is very small compared with semiconductor amplifiers.

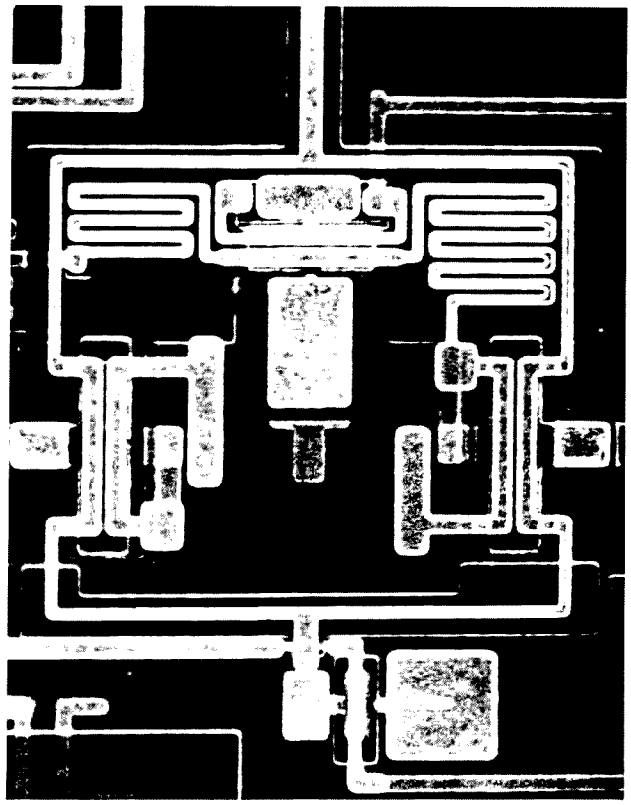


Photo B. This Josephson circuit is used in an oscilloscope system which is capable of measuring extremely fast signals. The Josephson Junction is the small circle in the center.

Superconducting technology is found also in circuits that have to pass very large currents. The strongest man-made magnets use superconducting coils. Extremely high current densities are possible in such coils (10^6 Amperes per square centimeter). The strongest superconducting magnets are capable of producing magnetic fields in excess of 8 Teslas, whereas the strongest conventional electromagnets are able to deliver only .3 Teslas.

Superconducting magnets are found in most laboratories that are attempting to develop fusion power. In order to generate power by fusing hydrogen atoms into heavier atoms, extremely high temperatures have to be attained. All solid walls would evaporate long before such temperatures could be

reached. But superconducting magnets may be able to generate magnetic fields that are so strong that these can act as substitutes for solid walls in fusion-power experiments.

An experimental levitated train system that has been developed in Japan uses superconducting magnets to lift the train. The train is, therefore, suspended in the air a few inches above the track. Due to the absence of mechanical friction, speeds of 320 mph have been reached in this levitated train system.

In the future, superconducting coils may be used for storage of electrical energy. Extremely high current densities are possible in such a storage system, and this may make it competitive with other power-storage systems. Once a current has been started in a superconducting storage coil, this can be sustained with very little loss for several days.

Modern electrical generators can be very efficient; up to 98 percent of the mechanical energy may be converted to electricity. But even higher efficiencies are possible by using superconducting magnets in the generators. Such generators may reach efficiencies of 99.5 percent. For large electrical generators, these savings may cause superconducting magnets to be competitive with conventional magnets, despite the higher construction costs. Superconducting magnets may also become cost-effective in large electrical motors.

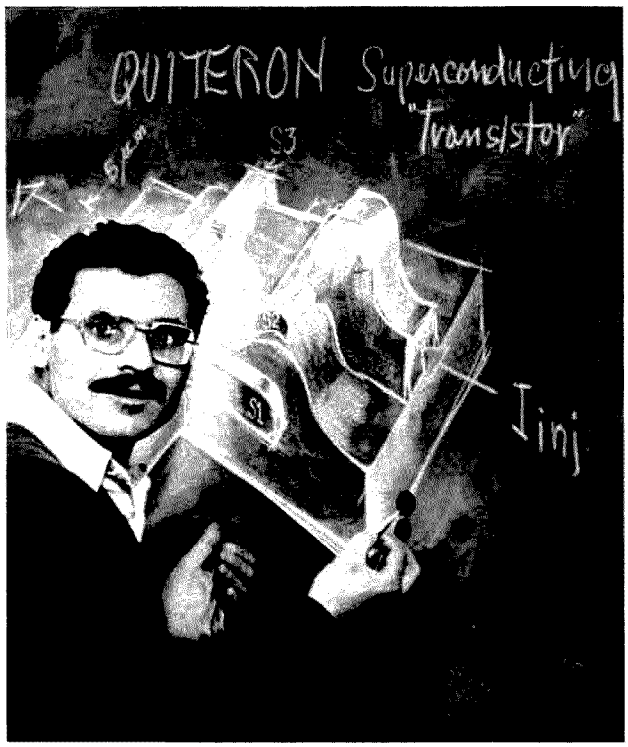


Photo C. The inventor of the quiteron, Sadeg M. Faris, and his new electronic device. The quiteron is a superconducting equivalent to the transistor, but works according to entirely different principles.

The main obstacle to a wide use of superconducting circuits is obviously the need to keep these circuits cooled to superconducting temperatures. Most refrigeration systems use liquid helium, which maintains the superconductors at a temperature of 4.2° Kelvin, the boiling point of helium. Helium is fairly expensive, and these refrigeration systems are not yet very reliable.

Many scientists believe that new superconducting materials will be developed which can become superconducting at higher temperatures than existing materials. A major milestone would be reached if one could discover a material which would turn into a superconductor at a temperature of 25° Kelvin or higher. This temperature is the boiling point of liquid hydrogen, and hydrogen-based refrigerators are likely to be much less expensive and more reliable than those that use helium as a refrigerant. The highest superconducting temperature which has yet been achieved is found in a niobium-germanium alloy. This alloy becomes superconducting at 23° Kelvin.

The Josephson Junction may be used as a very sensitive detector at microwave frequencies. Cooled parametric amplifiers have been used for EME work. Some years from now, superconducting components and refrigerators may become available from surplus stores and other sources. It is then possible that some new uses for superconducting electronics will be found in amateur-radio stations. ■

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Herb Brody, "Superconductors: Finally Ready for Business?", *High Technology*, February, 1983.

Juri Matisoo, "The Superconducting Computer," *Scientific American*, May, 1980.

R. T. Miller, "Josephson Power Supply Patented," *IBM Research Highlights*, July, 1978.

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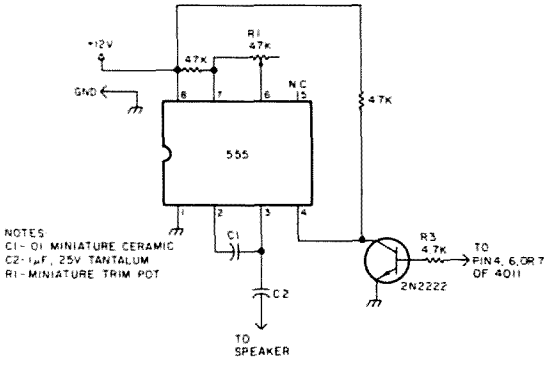


Fig. 1. Schematic.

If you are driving and are over forty (years old, not mph), you may have noticed how difficult it is to read a small digital display while in motion. In most cars the dial is not in the driver's line of sight, and in my case, I get tired of asking my wife if the display is scanning. It is dangerous when I am alone and have to take my eyes from the road to see the display. Also, sometimes a short noise stops the scanning, or the mike button doesn't start as it should.

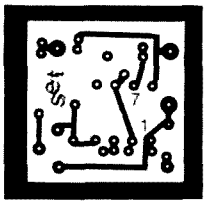


Fig. 2. PC board.

I know that the talking dial is coming, but in the meantime, for safety, I have equipped my Yaesu 227 RB with a beeper to assure me that it is scanning. This gadget will work with most transceivers. The beeper is like a birdcall or the sound of the synchronization operation on the Collins S-line (old-timers will recall this). The cost is around $4.00 for new parts or much less using your junk box. Look at the diagram: It is only a 555 integrated-circuit oscillator and a 2N2222 transistor inverter. I installed my unit in place of the optional tone squelch. If you have the squelch, install the beeper near the speaker in the bottom part of the transceiver.

In the 227 RB do the following: Open the top cover by removing the five Phillips screws. You will note a piece of gray cardboard fastened with three screws. Remove them, lift out the cardboard, and then raise the edge of the printed circuit nearest the dial only enough to

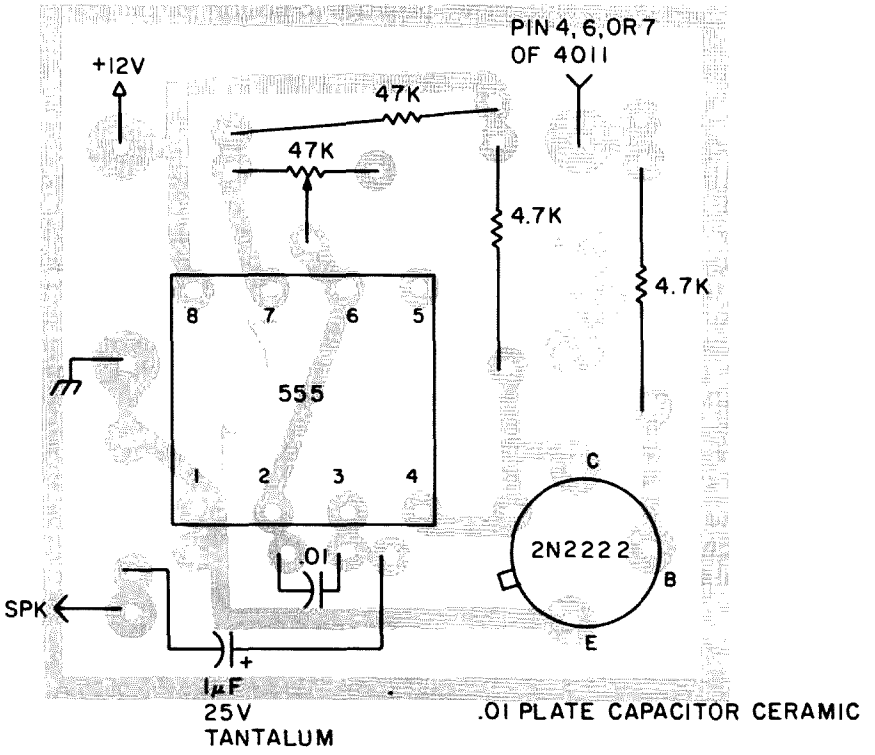


Fig. 3. Component layout.

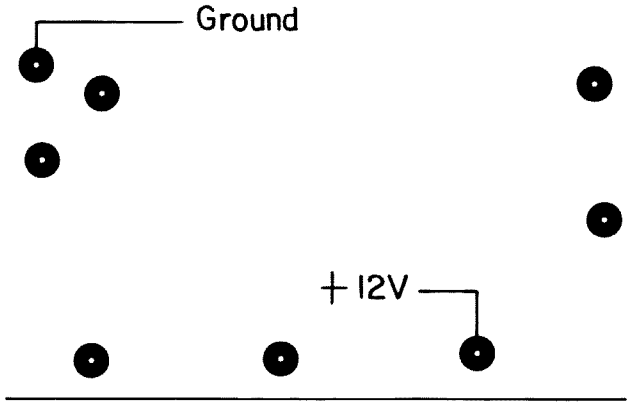


Fig. 4. Tone-squelch pin locations, seen from the dial side.

locate the MSM4011 integrated circuit. This IC is the scanning oscillator; it is in the center of the board and has 14 pins. Note that pins 4, 6, and 7 are tied together on the foil side.

At this point you should carefully solder a 4-inch piece of insulated wire if the beeper is to be located in place of the tone squelch, or a longer one to reach the speaker area if your beeper will be located there. The use of a small battery-powered or insulated iron is recommended as the IC is a CMOS.

Install the finished printed circuit by connecting the two wires (for the ground and the +12 V) to the pins indicated in the tone-squelch pin diagram (Fig. 4). The wire from the beeper that goes to the speaker is connected at the accessory jack, pin number 1. This pin is the one with a blue wire and a small ceramic condenser to the chassis. The last one is connected from pin 4, 6, or 7 of the MSM to R3 of the beeper. Fasten the circuit to the transceiver PC board with two drops of RTV. If you are locating it near the speaker, make the same connections with longer wires, routing them around any hot transistor. When the work is finished, connect the antenna and the 12 volts and try the scanning button. You should hear a low-volume beep when scanning. With the trimpot, adjust the tone to your taste. I am sure you will find this modification very helpful.■

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Resistors, all 1/8 or 1/4 Watt	(Jameco prices)
1 47k	$ .11
2 4.7k	.22
1 Trimmer pot. 47k	.39
Capacitors	
1 C1—.01 μF miniature ceramic	.08
1 C2—1 μF, 25 volts tantalum	.29
IC/Transistor	
1 NE555P	.35
1 2N2222	.33

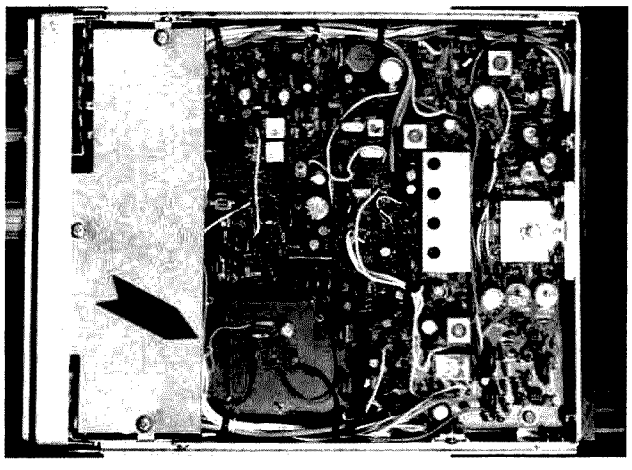


Photo A. Circuit installed in the place of the optional tone squelch on the Yaesu 227 RB.

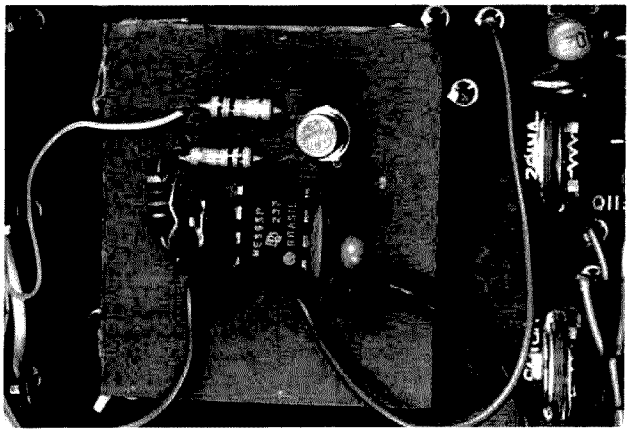


Photo B. Assembled printed circuit board.

A Better Money-Maker

WA6TTY stiffens up his original power supply to deliver a solid 13.8 volts at 20 Amps. The cost? Under three bucks!

Kenneth D. Wyatt WA6TTY
Ehrhorn Technical Operations
PO Box 888
Canon City CO 81212

This article describes a simple method of improving the output regulation of the "Money-Maker Power Supply" (*73*, November, 1982).

I have been using the unmodified supply for the past four years with good results. At a full load of 20 Amps, however, the output voltage drops by up to one volt. Numerous readers have noted this anomaly. W4CNQ wrote and suggested using a Fairchild 78GU1C voltage regulator instead of the LM317. Although the 78GU1C is not as widely available, it does improve the regulation remarkably. The reason for this is its fourth "sense" lead.

The basic problem with the original power-supply circuit was the voltage drop across the base-emitter junction of the pass transistors (see Fig. 1). When biased into the active region, there is normally a base-to-emitter junction voltage of about 0.7 volts. As the collector currect increases, this voltage differential also increases. For power transistors it can be as much as 1.5 volts or so.

The original circuit applies a regulated voltage from the LM317 to the pass-transistor bases. At low current levels, the base-emitter drop is fairly constant; thus the output voltage stays fixed. As the output current increases, the voltage drop increases and causes the output to drop slightly.

The revised voltage-regulator circuit is shown in Fig. 2. The major difference is the addition of a voltage-sensing input to the regulator IC. This sense lead is connected directly to the positive output terminal of the supply. As the output voltage decreases with more load, the sense lead tells the regulator IC to boost the base voltage to the pass transistors. This feedback loop cancels out the voltage drop and the output voltage will stay nearly constant.

The 78GU1C may be purchased from Circuit Specialists, Inc., PO Box 3047, Scottsdale AZ 85257. The part costs $2.10, and $1.25 must be included for shipping (1983 catalog). Note that the part is mislabeled in their 1983 catalog as "78GI1C". The device is housed in a TO-220 package. The pin connections are shown in Fig. 3. The 78GKC may be used as an alternate part (TO-3 case). The price is $2.75.

Circuit Description

I used a 78GU1C as the voltage regulator. A 2N3055 was used to boost the drive

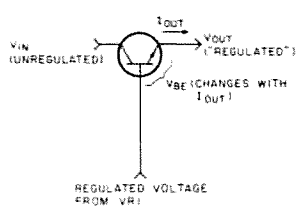


Fig. 1. Pass-transistor circuit. As the output current increases (Iout), the base-to-emitter voltage drop will increase (Vbe). This will cause the output voltage (Vout) to decrease slightly.

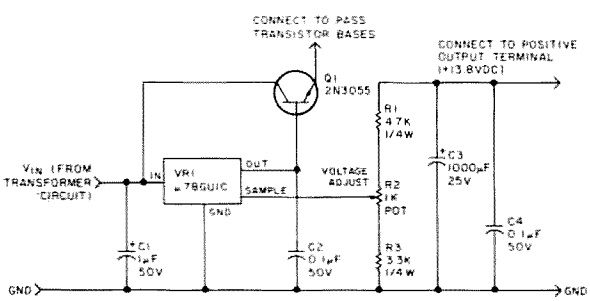


Fig. 2. New regulator circuit. The addition of a sample input on the voltage regulator creates a feedback loop which tends to keep the output voltage of the supply steady.

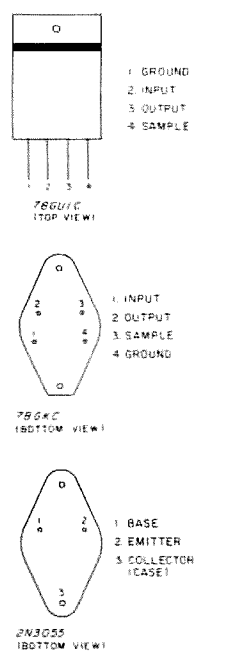


Fig. 3. Base diagrams. Note that the pin connections for the two voltage regulators are different.

current to the pass-transistor bases. Two bypass capacitors (C1 and C2) are mounted as close as possible to VR1. They prevent rf from upsetting the regulator and also act to prevent the regulator from oscillating. Resistors R1, R2, and R3 form a voltage divider for the sample input to the regulator. For the values shown, the output voltage is adjustable from 10.8 to 14.0 volts dc. Capacitors C3 and C4 filter out any noise or rf from the sample input.

Once all the new components are collected, it is time for surgery. Remove the original voltage-regulator circuit from the power supply. This will consist of VR1, R1, R3, C3, and C4. Refer to Fig. 3 in the original article. R2, C3, and C4 may be reused in the new circuit.

Next, install the new VR1 and Q1 to the chassis. Isolate Q1 from the chassis using mica or plastic insulators. Don't forget to use a little silicone grease in the junction area. Finally, wire the remaining components in a point-to-point fashion using a terminal strip if required. Make sure that all four capacitors are mounted close to VR1.

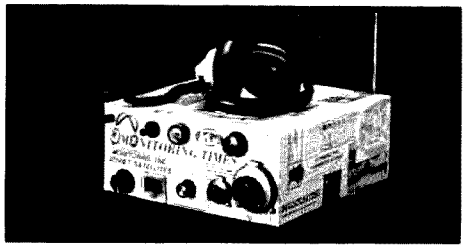
Double-check all added wiring and remove any load from the supply. Adjust R2 for 13.8 V dc at the output terminals. Now reconnect your radio and you should be in business.

Conclusion

My supply stays in regulation out to 18 Amps. After that point it starts dropping down slightly. Your supply may differ a little due to transformer type or construction technique.

I guess the moral of the story is that it's OK to use LM317s for low-current applications, but use feedback techniques (78GU1C) for high-current applications. ■

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The Commodore 64 already has an RS-232C interface built in. It's part of the user port. The only problem is that the voltage levels at the user port are TTL, and we need RS-232C levels.

Now hold on a minute. Just what are these levels I keep rambling about? And what is this RS-232C? First, the TTL levels are the voltage levels the computer talks to itself with. They are usually a +5 volts dc for a mark, or logic one, and 0 volts dc for a space, or logic zero. RS-232C is a little more complicated. Rather than discuss everything about RS-232C, let's just look at the basics.

RS-232C is a standard. It was set up by the Electronics Industries Association (EIA) to provide a standard interface for computer and peripheral manufacturers. The standard interface allows one manufacturer's computer to be used with another's printer or another's modem, etc. The standard, however, is not required. Some manufacturers don't use it. Those manufacturers that do, generally use a DB25 connector. As can be seen in Table 1, each pin has a designated name and function. Rather than discuss all of the pins, let's look at the three pins we'll be using for our printer interface.

The three pins we'll be using are pin 2, pin 3, and pin 7. Pin 2 is Transmitted Data (TD), which carries the data transmitted from the computer to the outside world. Pin 3 is Received Data (RD), which carries the data received by our computer from the outside world. Pin 7 is Signal Ground, which provides a ground return path for TD and RD.

The voltage levels used on the Transmitted-Data and Received-Data pins are also defined by the RS-232C standard. A mark, or logic one, will be a voltage level between −3 and −25 volts. A space, or logic zero, will be a voltage level between +3 and +25 volts. Since the RS-232C and TTL voltage levels are different, we need something to convert the levels from one to the other.

Several manufacturers build integrated circuits to do this conversion. The ones we'll be using are manufactured by Motorola. They are the MC1488 and the MC1489. The MC1489 is a quad line receiver. It is used to convert the received data

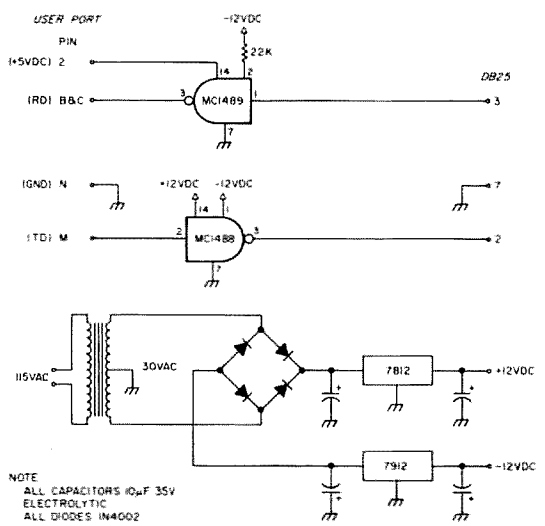


Fig. 1. Schematic.

Pin	Name	Function
1	FG	Frame ground
2	TD	Transmitted data
3	RD	Received data
4	RTS	Request to send
5	CTS	Clear to send
6	DSR	Data set ready
7	SG	Signal ground
8	DCD	Data carrier detect
9		Reserved
10		Reserved
11		Unassigned
12	(S)DCD	Secondary data carrier detect
13	(S)CTS	Secondary clear to send
14	(S)TD	Secondary transmitted data
15	TC	Transmitter clock
16	(S)RD	Secondary received data
17	RC	Receiver clock
18		Unassigned
19	(S)RTS	Secondary request to send
20	DTR	Data terminal ready
21	SQ	Signal quality detect
22	RI	Ring indicator
23		Data rate select
24	(TC)	External transmitter clock
25		Unassigned

Table 1. RS-232C pin designations.

1 =	50
2 =	75
3 =	110
4 =	134.5
5 =	150
6 =	300
7 =	600
8 =	1200
9 =	1800

Table 2. Data rate conversion.

from RS-232C levels to TTL levels. The MC1488 is a quad MDTL line driver. It is used to convert the transmitted data from TTL levels to RS-232C levels.

That's enough theory for now; let's look at the schematic (Fig. 1). As you can see, the circuit is fairly simple. All that's needed is a plus and minus 12-volt-dc power supply, one resistor, the two chips, and a couple of connectors. Since the circuit is so simple, go ahead and build the durn thing. When you're finished, come back here and finish reading. We still need to discuss some software.

Well, now that you've finished building the printer interface, you're going to need some software to make it work. There's a pretty good program on page 357 of the *Commodore 64 Programmers Reference Manual*. If typed in exactly as shown, it will transmit and receive ASCII data at 300 bits per second. If 300 is too slow or too fast for what you want to do, it's real easy to change. Line 100 reads like this: 100 OPEN 5,2,3,CHR$(6)

The number 6 in parentheses is what sets the computer to 300 bits per second. By changing this number to one of the numbers shown in Table 2, you can operate your computer from 50 to 1800 bits per second.

Other programs should work equally well. You'll probably find one that works better. Anyway, this one will get you started. Hope you enjoy building and using your printer interface as much as I did.■

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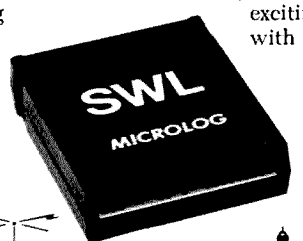
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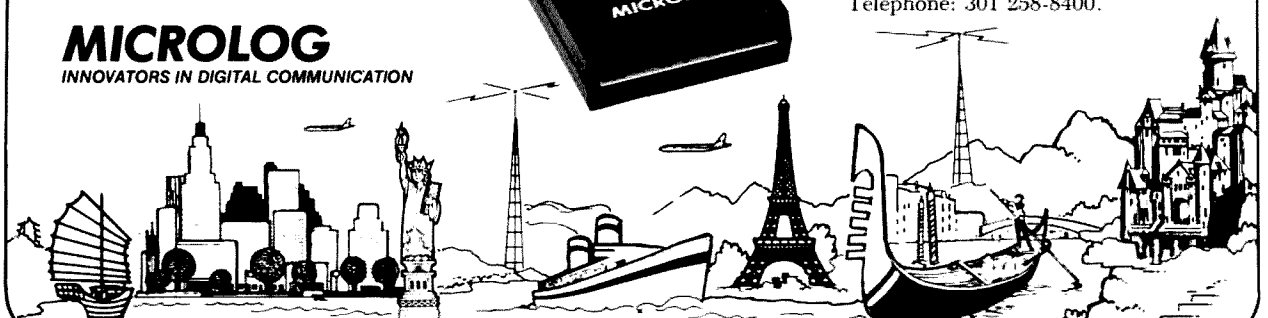
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Have you ever noticed just how un-standard the so-called standard RTTY shifts are in practice? 170-Hz shift seems to mean anything less than 400 Hz. In the past, every time I tuned in a nonstandard-shift RTTY signal, be it commercial or amateur, my longing for tunable filters only increased.

My quest for tunable RTTY filters has ranged from switched-capacitance active types (they never worked right) to an audio heterodyne system that was too complex to be worth the effort.

When I saw W9ODK's "Shoestring RTTY" TU using state-variable filters (*73*, January, 1985), the thought came to mind that such filters might be made tunable. The question was: Could the SVF maintain both Q and gain over the range needed to tune RTTY shifts of about 50 to 1200 Hz? A check of the filter design equations confirmed that such a filter should be possible, so two were built and tested. After a few kinks were worked out, a final unit was fabricated and installed in my demodulator.

The result was a continuously tunable filter allowing coverage of shifts from 80 to 1160 Hz. Tests showed both gain and Q to be nearly flat across the entire range.

The Circuit

Since many modern receivers have fixed bfo offsets and cannot pass the higher frequencies attendant to wider shifts, the final design was adjusted for so-called "low tones" (mark = 1275 Hz.)

The circuit (see Fig. 1) consists of two complete filters, each using a TLO84 BiFET quad op amp. The mark filter is fix-tuned at 1275 Hz while the space unit is tunable from 1355 to 2415 Hz. The pot used to tune the variable filter is a 100k dual-ganged, 41-step Radio Shack model (217-1732). The pot is billed as a "Stereo Control" and each section has a 40-percent-loudness tap which is unused.

R5 and R6 could be eliminated if a suitable 50k pot is available. Several junk-box pots were tried but produced poor results because the gangs were not evenly matched.

R3 and R4 should be closely matched as should

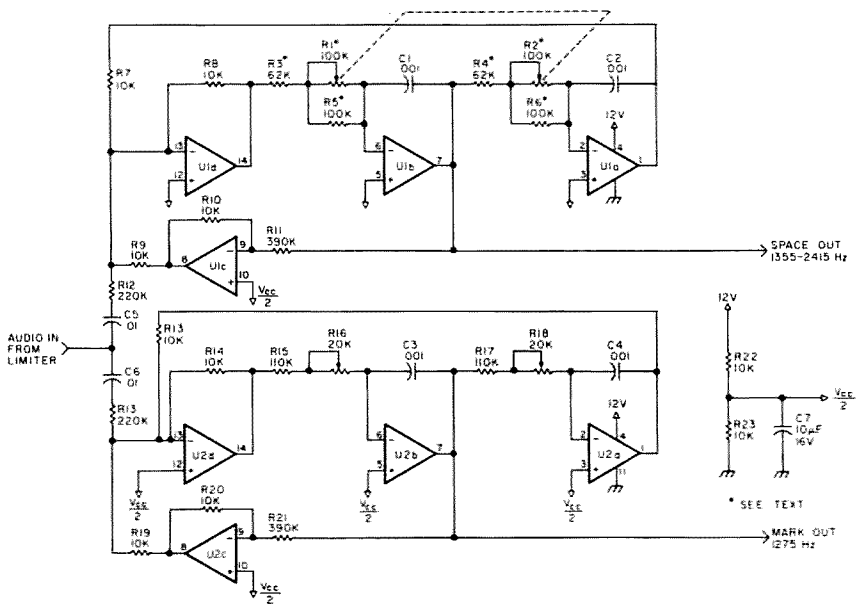


Fig. 1. Tunable RTTY filter.

Filter Center Frequency (Hz)	Shift (Hz)
1355	80
1445	170
1600	325
1700	425
1825	550
1975	700
2125	850
2275	1000
2375	1100

Table 1. Common shifts and their corresponding space-filter center frequencies.

R5 and R6. These resistors will determine the high and low end of the filter tuning range.

Construction

Just about any circuit-fabrication method can be used. I built mine on a PC card as a direct plug-in replacement for an existing filter card. The tuning pots replaced the filter switch on the front panel. Whatever the method of construction, keep in mind that some layouts may require the taming effects of ferrite beads on some or all of the inputs, outputs, bias lines, and the power-supply lead.

Also, do not lace or bundle the tuning control leads. The stray capacitance may cause problems, especially if the leads have to be more than a few inches long. Use polystyrene or mylar™ capacitors for C1 through C4. I used 15-turn PC trimpots for R16 and R18, but that is not really necessary.

Parts List

C1–C4	.001 mylar or polystyrene	$ .48
C5, C6	.01 disc ceramic	.16
C7	10-uF, 16-V electrolytic	.18
R1, R2	Dual-gang 100k pot (RS 271-1732)	1.79
R3–R15	¼-Watt resistors	.78
R16, R18	PC-mount, 20k trimpots	.50
R17, R19–R23	¼-Watt resistors	.36
U1, U2	TLO84 BiFET quad op amp	3.90
Misc.	2 14-pin DIP sockets, hookup wire, PC board, etc.	1.00
		$9.15

Parts available from Radio Shack, and Jameco Electronics, 1355 Shoreway Rd., Belmont CA 94002.

To align the fixed filter, feed in a 1275-Hz signal and adjust R7 and R8 for maximum output.

The variable filter should not need any alignment. To check it, however, feed in different tones and adjust the tuning control for maximum output. In each case, the output voltage should not change with frequency. Also, the output voltage should equal that obtained from the fixed filter, although a slight falloff may be noted at the extreme end of pot rotation. If the readings vary by more than a few tenths of a volt, check to see that both gangs of the tuning pot track together.

Results

While the gain and Q of the space filter are nearly flat across the entire tuning range, some interaction and phase shifting will be noted on shifts less than 125 Hz. This is easily overcome with a slight retuning of the receiver.

The filter is easiest to use when coupled with an oscilloscope. Tune the receiver until the mark signal yields maximum scope deflection, then rotate the filter-tuning control until the correct pattern or maximum space deflection is obtained. After years of switching filters, it takes a little getting used to.

Of course, if these filters are used with an AFSK generator for transmitting, make sure the tones transmitted are the same as those received. Otherwise, you will not be transmitting and receiving on the same frequency.

If the filter control is calibrated, then you can tell if that signal is 800- or 875-Hz shift. See Table 1 for a list of space-filter center frequencies and the corresponding shifts. The list can be used as a calibration guide.

With these filters, straddle tuning is no longer necessary. No matter what the shift, the maximum signal is being delivered to the detectors. ■

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15 Cent (.15) Per IC 74LSXX

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74SC238-1 Of 8 Non-Inverted
74SC239-1 Of 4 Non-Inverted
74SC240-Octal Buffer/Line Driver-Inv
74SC241-Octal Buffer/Line Driver-N/I
74SC244-Octal Buffer/Line Driver-N/I
74SC245-Octal Bus Transceiver Non-I
74SC373-Transparent Latch-Non/Inv
74SC374-D Type Flip-Flop, Non/Inv
74SC533-Transparent Latch-Inverted
74SC534-D Type Flip-Flop, Inverted
74SC540-Octal Buffer/Line Driver-Inv
74SC541-Octal Buffer/Line Driver-N/I
74SC563-Transparent Latch, Inverted
74SC564-D Type Flip-Flop, Inverted
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Double Your Computing Power!

Try "parallel processing" with a second CoCo keyboard.

This article describes how to add a second keyboard to your computer. It is simple in that no code conversion is attempted. The second keyboard is simply placed in parallel with the first. This will be of special interest to amateur-radio operators using the Color Computer.® They no longer will have to have the computer sitting in front of their radios taking up valuable desk space.

My wife and I run a secretarial service here in the Cleveland, Ohio, area. We have found our CoCo to be invaluable in this word processing area. The TRS-80C makes the thousand-dollar machines look like a big waste of money. Why buy a big, sometimes dedicated, machine when you can run two or even three CoCos for the same price? I do not believe that we realize how many computers like ours are out there in businesses. More public-domain programs to demonstrate the business end of the Color Computer would drive this home.

Although not into games, I do use the computer for code conversion on my amateur-radio system. As an avid code/radioteletype enthusiast, I cannot imagine going back to a keyer or mechanical teletypewriter. My Yaesu FT-980 radio is microprocessor controlled. The various ports are brought out of the radio and can be controlled by another microprocessor. The possibilities are exciting.

My problem was described by the old adage, "You can't mix business with pleasure." The CoCo had been kept on the radio desk. This allowed me to enter business documents while still keeping an ear to the radios. At times the CoCo really became a nuisance as it took up so much desk space; moving it to the side is difficult due to the wires and cables.

Checking some of the local computer outlets, I found their units to be (typically) way overpriced. Keyboards are available through mail order, but matching enclosures could not be found. Many of these keyboards would require reformatting to work with the Color Computer.

This was when our 16-month-old daughter came by with her "computer"—the old bubble-bump key-

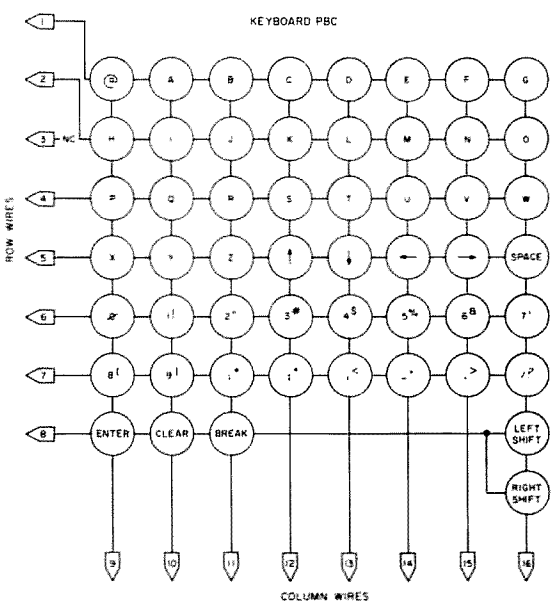


Fig. 1. To test your new keyboard, connect a battery-operated test lamp or an ohmmeter between any row and any column wire. Ensure that the respective key operates. For example, if wire 4 and wire 13 are checked, key T should establish continuity. Repeat for each row and column wire.



Photo A. The new addition to the radio shack.

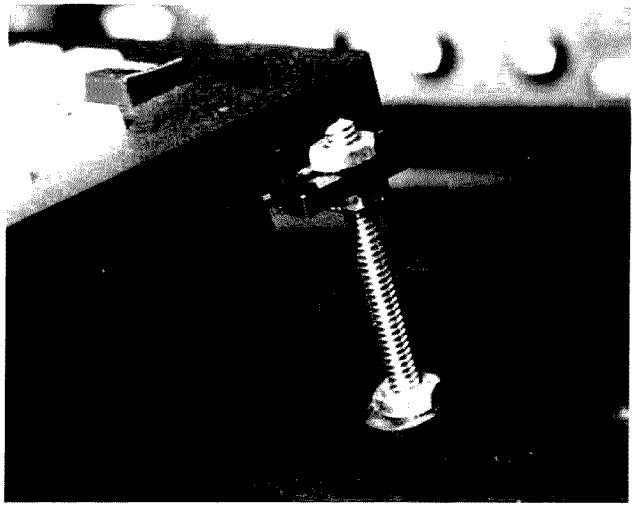


Photo B. Keyboard rear leg with rubber foot.

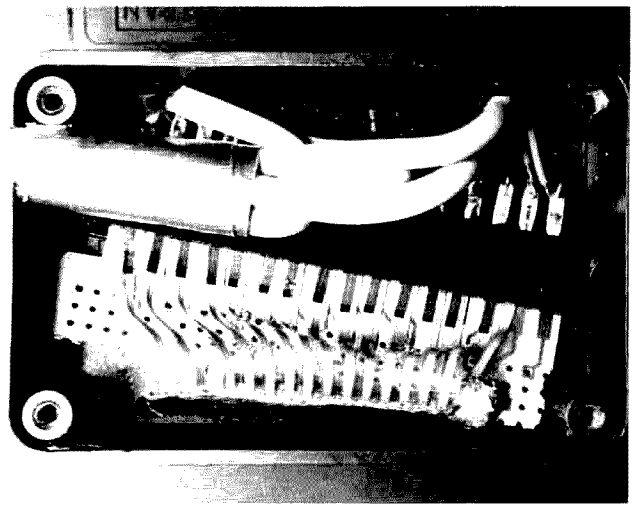


Photo C. Box for connections.

board which I had given her when I modified my computer by giving it a real typewriter keyboard. My wife yelled, "Indian giver!" as I took the old keyboard into the workshop.

Modifying the Keyboard

The keyboard is a small, self-contained unit not needing an enclosure. However, you will need a box to keep the connections immobilized. If they are bumped and jiggled, they will eventually fail. The mounting brackets on the side provided a location for hardware rigged to hold the keyboard at the proper angle.

All parts were scavenged from various junk boxes. A parts list is an excellent breeding ground for creativity. If you do not have a part, try to come up with something you can substitute for it. If you do not have rubber feet for the keyboard, perhaps you can locate some rubber-like material from somewhere else, or check the attic and basement for some discarded appliance that may have rubber feet you could use.

The keyboard is connected to the computer via the 16-conductor ribbon cable coming out of the back of the connector box. (Pin 3 of this cable is not used: I write about 16 conductors only because of the type of wire that I used. You may substitute 15-conductor cable anywhere that 16-conductor cable is called for.)

Cut a slit in the bottom of the box for the ribbon cable to fit through. Measure the cable and mark the box. Drill a hole at one end of the mark, fit a coping-saw blade into it, and carefully cut the line. If you do not have a coping saw, perhaps the slit could be made (in a plastic box) using a hot knife or soldering iron. A hand mototool would be ideal for this step. Wrap tape around the ribbon conductor to protect the cable from chafing on the edges of the slit in the box.

The following step, cutting and gluing the ribbon cable, is not necessary if you can locate a proper connector for it. You cannot solder against the plastic of the cable; it just disintegrates.

The connection to the keyboard is formed using a card-edge socket and a plug-in board for this socket. Since the spacing of the connections on the ribbon cable is different from the spacing on the plug-board, the ribbon cable connections will be repositioned to match the plug-in board. With a pair of scissors, cut the conductors of the ribbon cable apart. Feed the cable through the slit and glue the box to the back of the keyboard.

Sixteen-conductor cable will be run from the second keyboard to the computer. This cable can be hard to find, but it is easy to fabricate. Rotor cable in 3, 4, and 5 conductors is available at most department stores. Four-conductor phone line can be found at Radio Shack and is quite flexible.

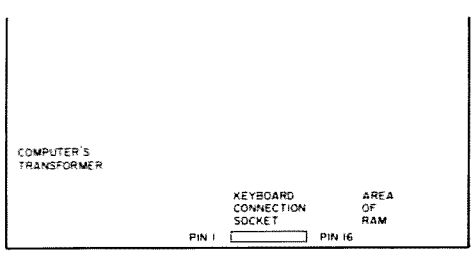


Fig. 2. Front of the computer.

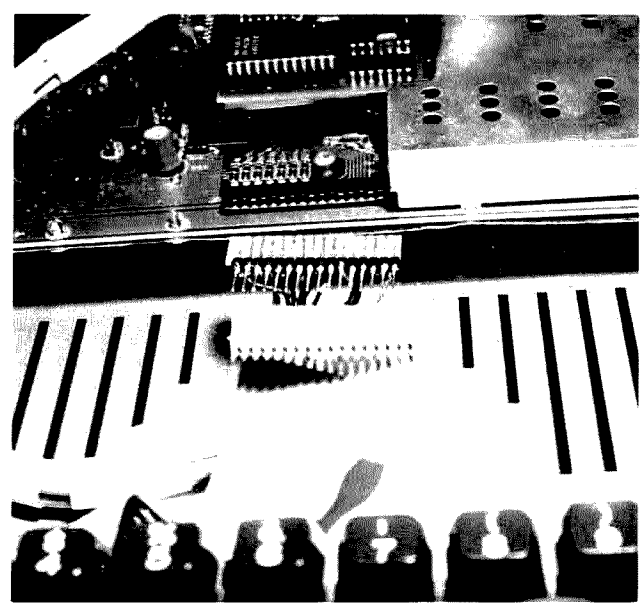


Photo D. Keyboard connectors come into the bottom of the computer.

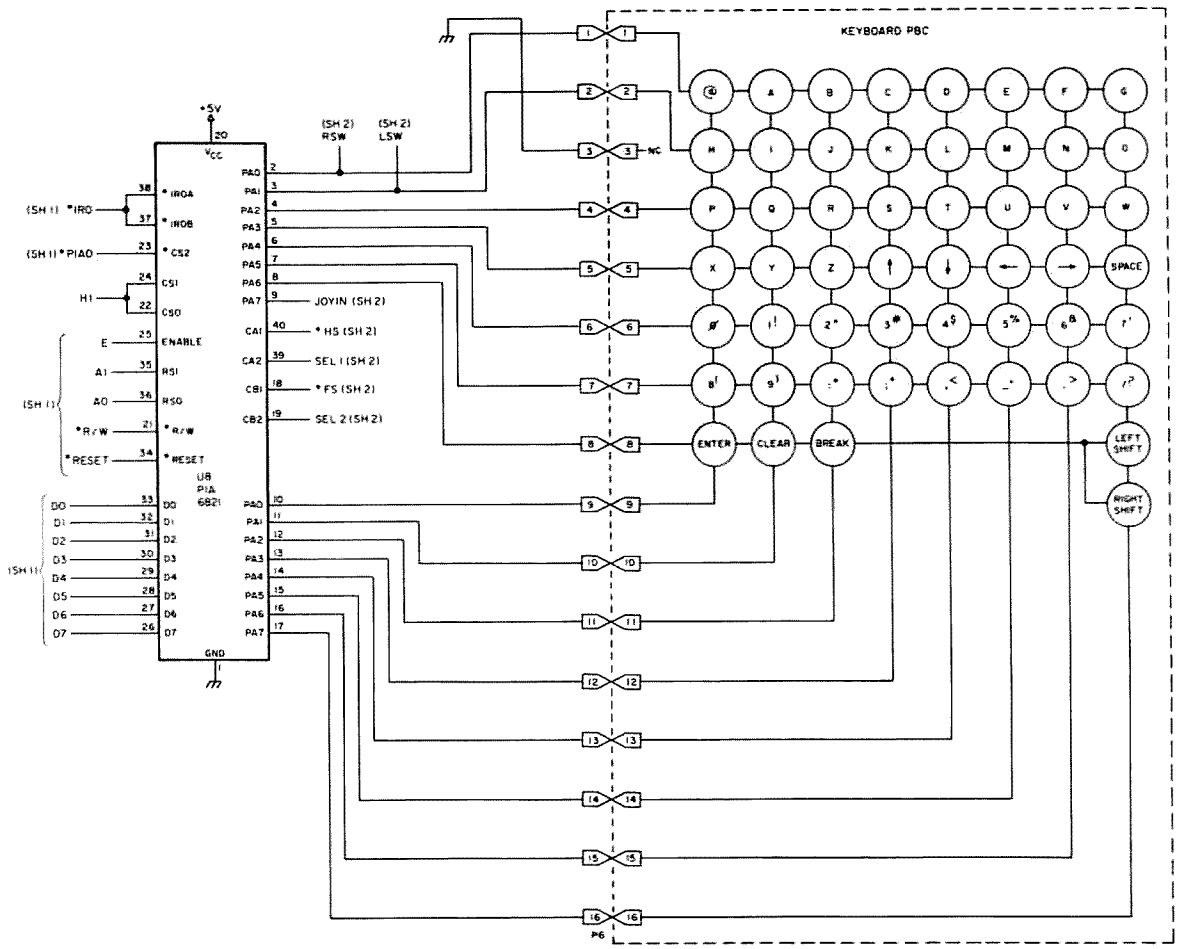


Fig. 3.

Determine how far you want to go with the keyboard and cut as many runs of the cable as you need to make the 16 conductors. I used 4-wire phone line, 25 feet long; four runs made 16 conductors. Tape the cables together every six inches or so to keep things neat. Masking tape is cheaper than electrical tape for this purpose.

Now you will have to decide if you wish the second keyboard to have a connector. The alternative is to wire the keyboard directly to the computer. This means you will have to gather up the extra keyboard with the computer when you move them. Skip the next few steps, which are for the connector, if you are not going to use one.

Cut another 16-conductor cable; this time make it two feet long. It will be used inside the computer. Set it aside.

A 25-pin D connector is used in these steps. These connectors are difficult to solder. A small soldering iron and tweezers will make the job easier. Shorts can be avoided by using as little heat as possible so that the insulation on the wires is not burned away.

Solder each set of wires in a predetermined order. If you solder red, black, green, and yellow each time, you need find the position of only one wire to know where the other three go. If you are using rotor cable, you will find one wire is different. Again, pay attention to the order in which they are installed.

Use the female connector for the back of the computer. If something falls on the computer, it is less likely to short the female connector than the male.

Take one end of the 16-conductor cable you fabricated and solder it to the male D connector. Install the hood over this connector. Set the cable aside.

If the box that was installed on the back of the keyboard is too small to fit the card-edge socket, the socket will have to be cut. Cut between the 17th and 18th set of terminals on one side of the socket. That way you will not need to worry about damaging the 16th terminal. If more room is needed, cut off the mounting hole. Only the top or bottom set of terminals will need to be used. The other set of 16 terminals can be cut off.

Cut the plug-in board perpendicular to the terminals. Leave enough to be able to grasp the board to plug it in. If you cut the connector, cut the board's length to match.

Using the plug-board as a guide, glue the ribbon cable terminals over the plug-board terminals. Super glue, if used carefully, works fine. The connector will be tight due to the additional material of the ribbon conductors so be sure your glue will hold.

Use an ohmmeter or battery-operated test lamp to determine which wire of the cable is attached to pin one of the D connector. Solder this to the terminal on one side of the card-edge socket. Do the same for the 15 other wires.

Plug the board into the card-edge socket. Place the connection into the box. If it is loose, a drop of glue will

secure it. File a hole in the top of the box for the cable to come out. Put tape over the cable so it fits tightly in the hole. Put the cover on the box.

Glue two rubber feet on the bottom front edge of the keyboard. Threaded rod is used to lift the back of the keyboard to the proper angle. Cut the rod so that it gives an angle that will suit you. Two nuts secure the rod to the top of the keyboard. Put a nut onto the bottom of one of the rods and screw a rubber foot on after the nut. Glue the nut to the foot. Do the same for the other rear foot. A dab of glue to all the nuts will keep things secure.

Modifying the Computer

Unplug the computer and take the top off. The female D connector is installed on the rear of the cover over the output ports. Install it with the flange on the inside of the cover.

Mark where the hole should be placed and cut it out. A coping saw works well here, too. File the hole clean and make sure it is large enough to allow the male connector to fully seat in the matching cover. If the hole is too small, the connector will get hung up on the cover plastic and will not fully seat. Drill the two mounting holes.

Prior to mounting the connector, attach the two-foot piece of 16-conductor wire. Two washers on the outside of the connector's mounting bolts will keep them from digging into the plastic of the computer case. Bolt the connector in.

Attach the connectors together. Use Fig. 1 to check the keyboard for proper operation. Put a bit of tape over the wires to indicate their respective pin numbers as you check.

Remove the CoCo's keyboard. (I had replaced the original with a Hi-Tek keyboard which came with an adapter that slides into the CoCo's keyboard connector. It was a very easy job connecting the cable to this connector. I just slid it out a bit, soldered the wires to the very back of the pins, and slid the connector back in. If you do not have this adapter, try sliding the wires into the connector with the wires of the other keyboard and tape the two sets of wires together.)

Now is a good time to check for problems with your typewriter keyboard. Sometimes the larger keys, the <Enter>, <Shift>, and <Space Bar>, will begin to bind. On most units the key-tops are easily pulled off. A dab of Vaseline will restore proper operation.

Button up the computer and plug it in.

One More Thing...

You now have a second, small keyboard on your computer. As you can see in Photo A, it can easily be moved out of the way of the radios. I will eventually change to an "expensive-grade" keyboard, but for now the CoCo's old keyboard fulfills all my needs.

Oh, one more thing. If one feels guilty about stealing a keyboard from a toddling daughter, just take her out for some ice cream. The whole TRS-80C probably will be hers before long. ■

Parts List

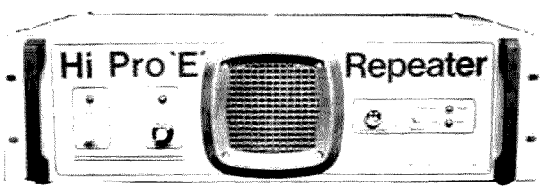
An old (or new!) CoCo keyboard
16-conductor cable (see text)
Small plastic box (270-230)*
Male D connector (276-1547)
Female D connector (276-1548)
Hood for D connector (276-1549)
Card-edge socket (276-1551)
Card-edge board (276-152)
Four rubber feet
About 6" of threaded rod
Six nuts to fit the rod
Masking tape
Super glue

* Radio Shack part numbers.

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Working 2ICTU

Can RTTY get any simpler?

Those of you expecting a rare DX story are probably going to be disappointed. But if you're interested in trying RTTY and have a computer, you should find this article interesting. If your computer has a serial port, you can put it on the air with just two ICs and a handful of small parts. This provides a very simple and, most important, inexpensive way of trying your hand at RTTY.

Some time ago I built a function generator to help out with various projects around the shack. It's based on an EXAR 2206 IC which does all the work. While studying the spec sheets on this device, I noticed that it could also be used for FSK generation. Further digging around showed that EXAR also makes an IC that will demodulate FSK tones. These two devices seemed ideal for the construction of an ultra-simple TU that would interface my computer to my ham station. So, armed with the excellent data sheets provided by EXAR, I set out to build a RTTY terminal unit. The result is a compact and simple AFSK TU that works surprisingly well.

The 2ICTU serves a number of purposes around the shack. In addition to the fun of making RTTY contacts over the air, it has proved a useful accessory for my computer. It allows me to send programs over the air, which is a neat way of sharing my latest programming wizardry with friends who have otherwise-incompatible hardware. It also provides a way of backing up my more important software by running it out to audio tape. That way, if my disk drives or main tape unit go fratz, I am not completely out in the cold while

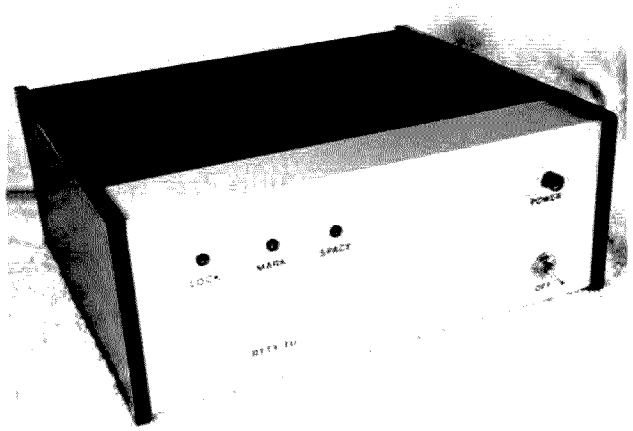


Photo A. The completed 2ICTU. I like to give my projects a professional look, so I use Ten-Tec enclosures. They cost a little more, but I believe they are worth it. The mark and space LEDs were never implemented; they're not really necessary.



Photo B. The rear panel with the multitude of connectors for the various inputs and outputs. The 5-pin DIN connector is used for the hookup to the serial port. The label indicates the 3 pins used: transmit data, receive data, and ground. The switch is for reversing the "sense" of the RTTY signal via the exclusive OR gates on the serial board. The audio-level trimpots are visible below the audio and tape outputs. The "audio" input and output are used for the connections to the rig.

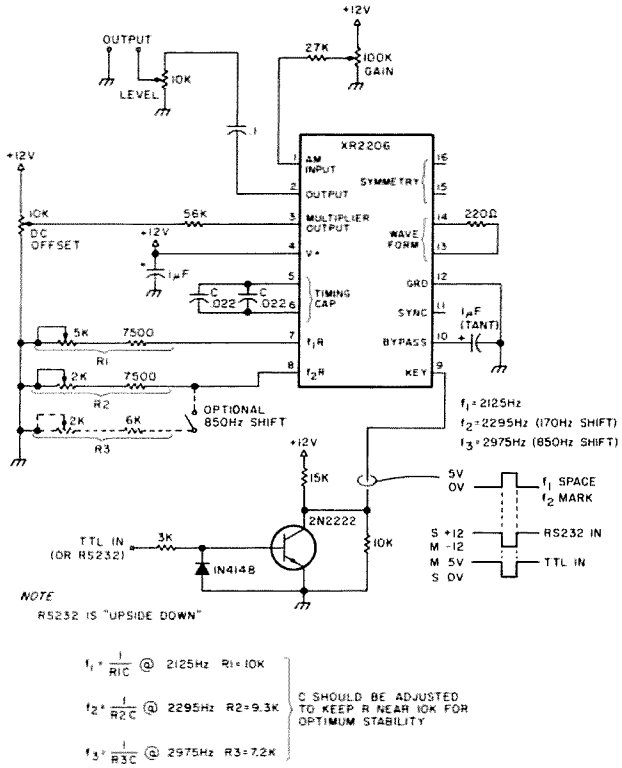


Fig. 1. The AFSK unit.

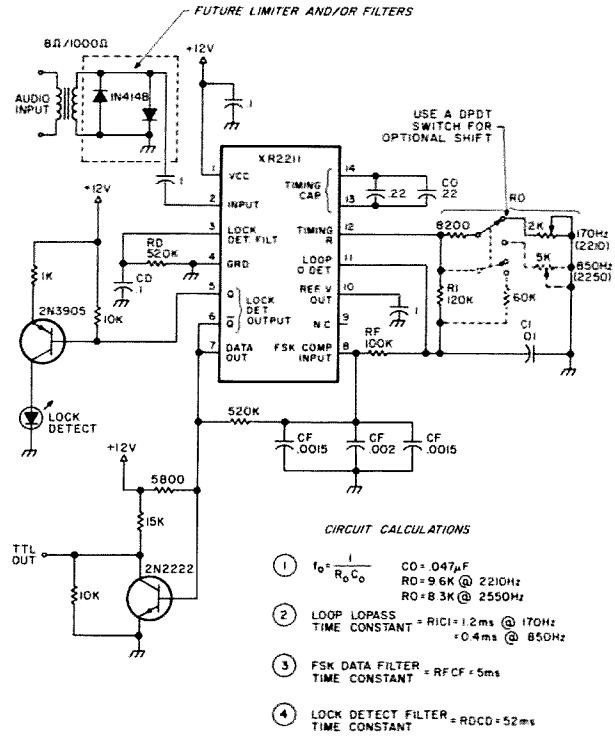


Fig. 2. The AFSK demodulator.

repairing them. Backup on a completely different medium such as this is the most secure way of protecting yourself from total disaster.

For those of you who may not have a serial port with a controllable baud-rate generator on your system, I have also included my general-purpose serial port. It is designed for the S-100 bus, but with a little thought can be modified for any computer. The configuration of the hardware makes it particularly easy to modify for the Commodore 64 or VIC-20 or any other 6502-based system. I have included the necessary circuit changes for those of you with these computers who might like to build the 2ICTU.

The modular concept of the 2ICTU should make it easy for you to extract only those parts required by your particular combination of computer and radio gear. It also allows you to plug in any additional items you might like, such as additional filters, blinking lights, etc.

The software is what really makes the 2ICTU shine. A good software package makes this minimal hardware perform like a much more expensive unit. What's more, since it's my package, I can get into it and tinker around to my heart's delight. Anything I want to add or change is a simple matter of changing the coding to customize it to suit my needs and desires. I wrote some simple machine-language routines to interface the computer to the 2ICTU for storing and recalling data and programs on audio tape. The "bells and whistles" program for the RTTY operation is written in Fig-Forth and provides many of the features of store-bought units, including split video for transmit, receive, and status portions of the screen.

Construction can be by whatever method you like; there's nothing critical or tricky about the circuits. Normal good building practices should provide you with a quality finished product. I built the 2ICTU on a surplus wire-wrap card and it has performed flawlessly for the past two years.

The AFSK Unit

The AFSK unit is an EXAR 2206 IC (see Fig. 1). This single chip does all the work and requires only that we add the required timing components to obtain the necessary frequency outputs. The schematic is straightforward and the only critical parts are, as usual, the timing capacitors—they should be polystyrene for maximum stability. No CW ID is provided since there are many and varied ways of accomplishing this depending on the hardware available in your particular circumstance. You should have little trouble adding one that suits your system. I built the 2ICTU for narrow-shift operation only, but have included the necessary parts for both narrow and wide shifts.

I won't bore you with a lengthy technical description of the circuit since the schematic is pretty self-explanatory. I recommend that you obtain the excellent data sheets provided by EXAR when you get your ICs. They will provide all the information you might want about this device. Indeed, the circuit shown is basically taken from the applications part of these sheets.

Tune-up is best accomplished with an oscilloscope and a frequency counter. First, adjust the dc offset and the gain trimmers for the best looking sine wave at pin 2. Next apply +5 volts to the input and adjust the mark frequency trimmer for 2295 Hz at pin 2. Then ground the input and adjust the space timing trimmer for 2125 Hz at pin 2. If you included the parts for the 850-Hz shift, also adjust the mark frequency for it. Finally, readjust the dc offset and gain controls for the best looking output. Keep the gain at the minimum level that provides a clean signal.

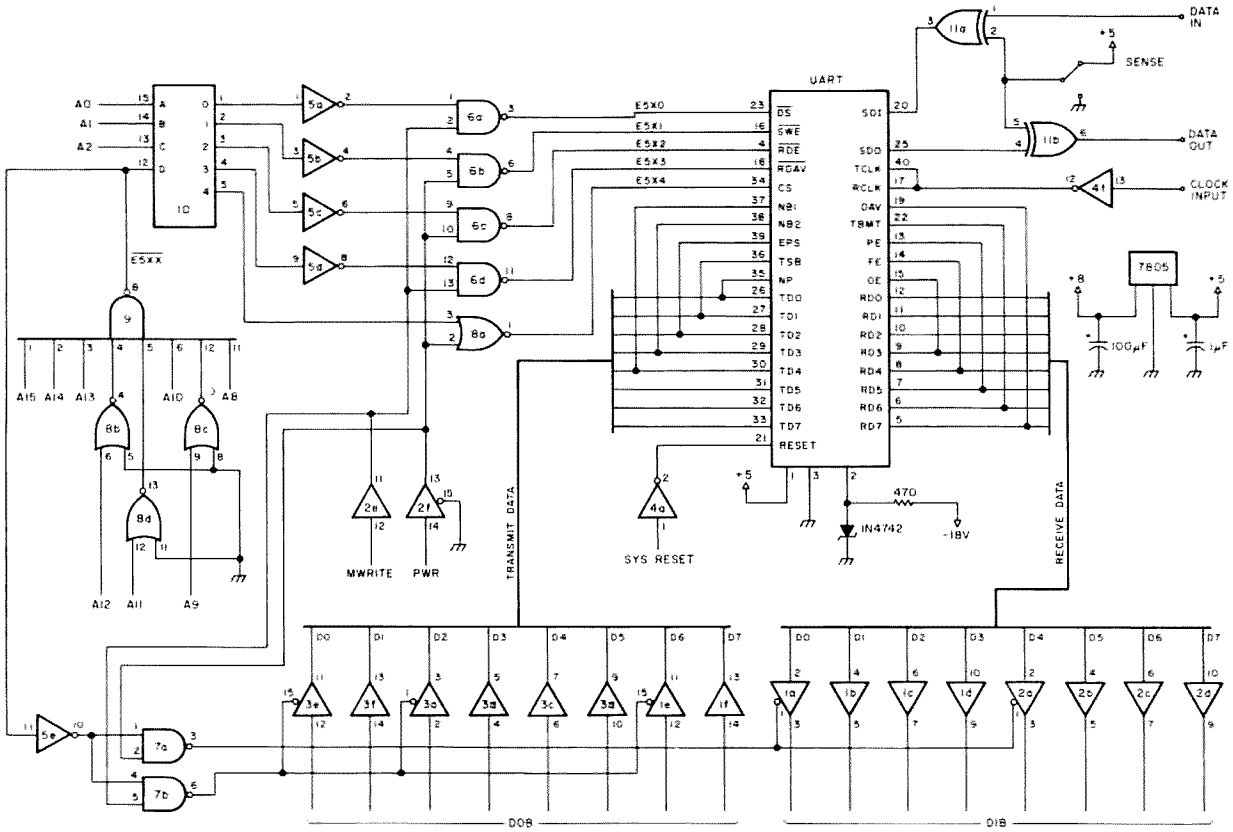


Fig. 3. The general-purpose serial port.

The 2206C provides an extremely stable and clean AFSK output. No distortion is introduced at the critical frequency transition point since the output is phase-continuous during this time.

The Demodulator

The demodulator circuit is as simple as the AFSK generator (see Fig. 2). I left plenty of space on my board for future filtering circuits but found that the built-in one works so well that I just never got around to it. An EXAR IC does all the work again, but this time it is the 2211. Once again, I recommend that you obtain the data sheets with the IC. They contain a wealth of information and will give you all the technical data you might want.

The gang of capacitors hanging off pin 8 provides the necessary FSK data filtering. Calculated values for these things seldom come out near anything standard, so the parallel group gets us close. As before, timing capacitors should be polystyrene for maximum stability. My system required only TTL levels so I did not include the added complexity of an RS-232 output (although the AFSK unit will accept RS-232 input levels). If your port requires these levels, you will have to add the necessary parts.

To tune the demodulator you will need only a frequency counter to adjust the center frequency of the internal vco. You do this with the lock-detect filter disconnected and no input signal. The easiest way is to remove the IC from its socket (you did use sockets, didn't you?) and carefully bend pin 3 out just enough so that it is out of the socket when you plug it back in. Now jumper pins 10 and 2 together, apply power, and adjust the trimmer (or trimmers) for the correct frequency at pin 3. This will be 2210 Hz for narrow and 2550

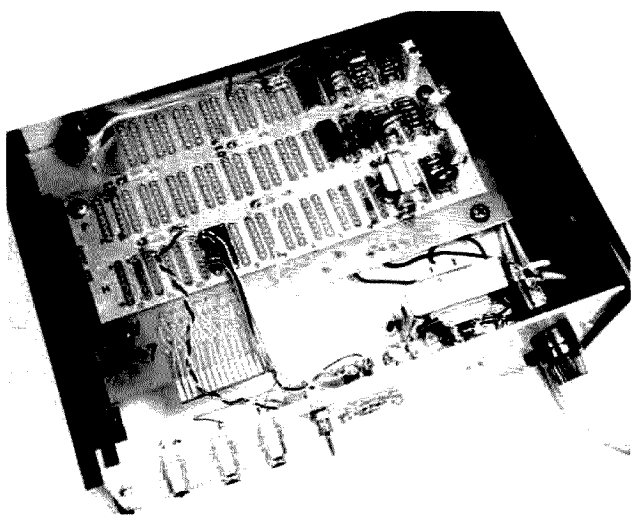


Photo C. The innards of the 2ICTU. As seen, there is plenty of room for expansion! The two EXAR ICs can be seen at the upper-right corner. In the lower-right corner is the 12-volt power supply. Just about anything will do since very little power is required.

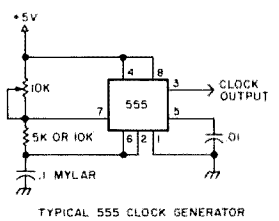


Fig. 4. Typical 555 clock generator.

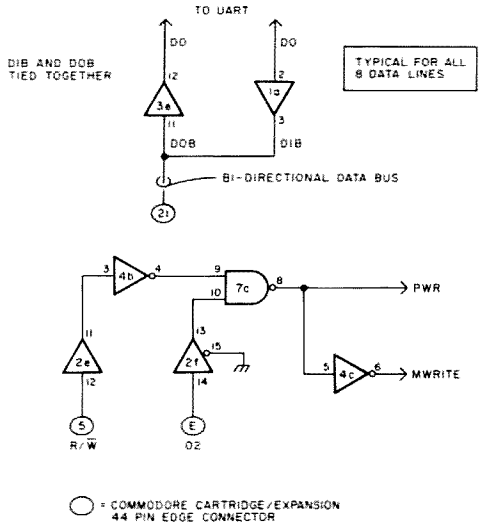
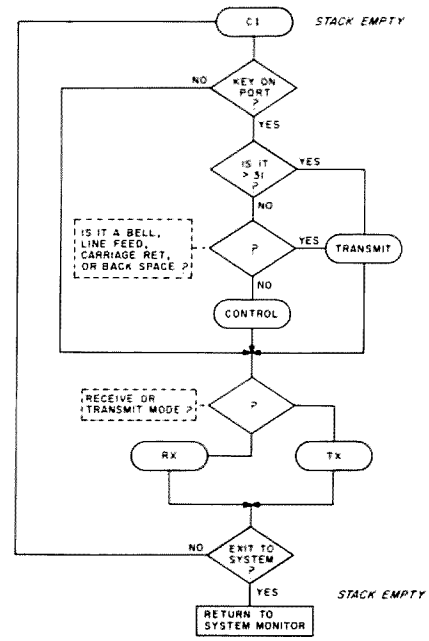


Fig. 5. Serial-port connection for Commodore computers.



Hz for wide shift. When done, restore pin 3 to its normal position.

In operation, tune the received signal until the lock-detect LED is on continuously. A flickering LED indicates improper tuning or a signal that is too weak. While the 2ICTU will certainly not match the performance of expensive commercial terminal units, I was quite surprised at how weak and noisy a signal the 2211 will copy. It does reasonably well even in QRM when the signal you wish to tune is stronger than the surrounding ones.

General-Purpose Serial Port

The serial port is not quite as simple as the 2ICTU (see Fig. 3). Still, it's pretty straightforward and not difficult to build. It uses a plain old garden-variety UART which does the majority of the work. The other ICs provide the necessary buffering and address decoding. The exclusive OR gates on the serial input and output provide for selectable "sense" on the RTTY signal.

The serial port as shown was designed for the S-100 bus. It does not, however, use the standard S-100 port-addressing method. I chose instead to implement it as a few memory addresses at the unoccupied end of my RAM space. I prefer memory-mapped I/O, and it suits the 6502 microprocessor used in my system. If your computer uses all available memory space or if the addresses shown are used, you will have to revise the addressing scheme to suit your system.

The address decoding is done by ICs 8, 9, and 10. As shown, they decode one page of addresses between E500 and E5FF hex. Only 5 locations are actually used.

The first location, E500 hex, is the transmit-register buffer of the UART. Data written here is converted to serial output at pin 25 of the UART. The necessary start, stop, and parity bits are determined by the word previously stored in the control register at E504 hex.

The second location, E501 hex, is the UART's status register. Reading this address places the status of the UART's operations in the high 5 bits of the returned-data byte. The overrun, framing, and parity-error bits are returned in bits 3, 4, and 5 respectively. If any of these are set, an error is indicated. Bit 6 is the "transmit buffer empty" flag. This bit must be interrogated and must be true prior to writing any new data to the transmit-register buffer at E500 hex. Bit 7 is the "data available" flag for received data. A true condition indicates that the UART has received a data word and it is available in the received-data buffer at E502 hex. Bits 0, 1, and 2 have no meaning. Bits 6 and 7 were chosen for the two busiest functions because they are simple to use for control of program execution in the 6502.

The third location, E502 hex, is the actual location of the received data. After determining that data is available, by bit 7 of E501 being true, a read of E502 returns the received-data byte.

After reading the received data, a write must be performed to location 4, E503 hex. This clears the data available flag for the next byte. The data written has no meaning since it is not actually used.

The fifth location, E504 hex, is the control register of the UART. A data word written here sets the various parameters required for the UART's operation. Bit 0 controls the use of a parity bit. When it is reset, or equal to zero, no parity is generated or checked. Bit 1 controls the number of stop bits appended to each serial byte transmitted and the number checked on each received byte. Zero equals one stop bit, while a 1 equals two stop bits, or, in the case of 5-bit words, one and one-half stop bits. Bit 2 is used to choose even or odd parity when parity is selected via bit 0. Bits 3 and 4 determine the length of the transmitted or received word. 00 equals 5-bit words, 01 equals 6-bit words, 10 equals 7-bit words, and 11 equals 8-bit words. Bits 5, 6, and 7 are not used. The control register is write-only. Once a control word is stored here it will remain active until it is changed. For Baudot code, I normally store an 03 hex and for 8-bit ASCII I store 19 hex.

Parts of ICs 5, 6, and 8 are used to gate the appropriate read and write signals to the UART. Two gates of IC 7 and one from IC 5 are used to control which set of buffers is activated, depending on whether a read or write operation is being performed. IC 11 is used to control the sense of the transmitted and received word for true or inverted RTTY. The actual control is performed by a

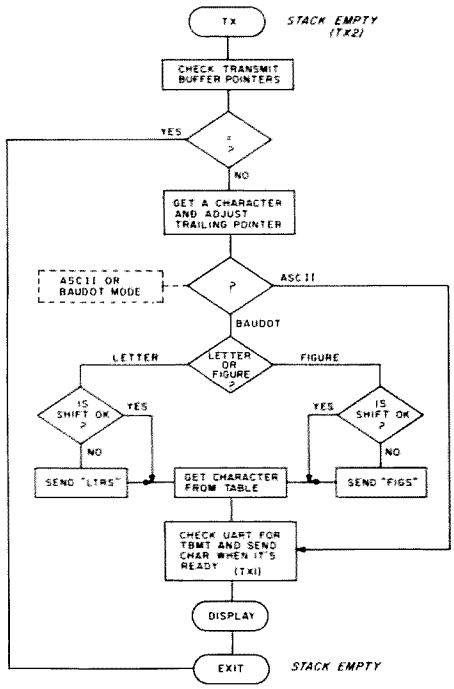


Fig. 7(a). The transmit module (TX).

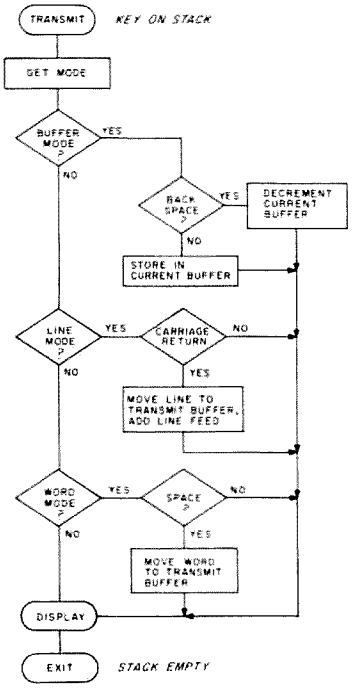


Fig. 7(b). The transmit-buffer control (TX).

SPDT switch located on the front (or in my case, the rear) panel of the TU. The data input, IC 11, pin 1, is connected to the FSK demodulator output and the data output (IC 11, pin 6) is connected to the FSK generator input.

I use 6522 VIAs for my system I/O. These are similar to the ports used in the Commodore 64 and VIC computers. The neat thing about these devices is that they each contain a pair of software-controllable timers. These timers are extremely useful, particularly where the 2ICTU is concerned. One of the timers can be configured to output a controlled square wave at bit 7 of the B port. By loading the appropriate 16-bit numbers in the count registers, I can generate any of the frequencies needed to operate the serial port for RTTY. The numbers I use for my 1-MHz system are 686 decimal for 60 words per minute (45 baud), and 282 decimal for 100 words per minute (110 baud). These numbers probably will differ on your system since no two clocks are ever quite the same. Different timer types also require different approaches. I found that the best way to determine the correct figures was to connect a frequency counter to the output and experiment with different values until I found the ones that gave frequencies closest to the ones I desired.

If no timers are available on your system you will have to provide a 555 or similar type clock generator for each of the two popular baud rates. A typical circuit is shown in Fig. 4. The clock frequencies required are 16 times the baud rate or 720 Hz for 60 wpm and 1760 Hz for 100 wpm. Two separate 555s are easier because, as you can see, the two frequencies do not share a common multiple.

Those of you with Commodore computers can modify my serial port for your computers quite easily. It is necessary only to combine the two data buses (DIB and DOB) into a single bi-directional bus and to synthesize the S-100 MWRITE and PWR signals as shown in Fig. 5. Your system reset signal will work as is. The 6526 ports in the Commodore computers contain a pair of timers like those in the 6522. You should be able to use these by connecting pin C of your user port to the UART's clock input at pin 13 of IC 4. The timer will, of course, have to be configured and initialized by your software. To configure the timer, load a C0 hex into the auxiliary-control register. The ACR is located 11 (decimal) locations above the base address of the port. Then load the 16-bit-count word into the counter latches at base +6 (low order) and base +7 (high order). The timer is started by storing the high order count into base +5 and stopped by storing zero into the ACR (base +11) or by doing a reset.

Software

That brings us to the software required to make this minimal hardware perform like an expensive RTTY unit. As I stated earlier, my software for RTTY operation is written in Fig-Forth. I urge any of you thinking about trying Forth to do so. It is an excellent language for just about any application. Like any new language, it may seem confusing and difficult to understand at first, but once you've worked with it for a while, you'll find it quite easy and natural to use. The RTTY program is contained in 25 screens of text. Each screen is a 1024-byte block of ASCII data arranged as 16 lines of 64 characters. I have included only the flowcharts with this article in the interest of keeping it compact.

For those who desire a complete listing, I can provide one if you send $5.00 to cover the cost of duplication and mailing. Also, I can write the screens onto 8-inch disks for single-density CP/M or OSI systems if you send a disk and $5.00. Obviously, the disk would only be of use to those of you with working versions of Forth. If you don't have Forth, or wish to try it, then you should be able to write the program from the flowcharts in your favorite language. Whatever language is used, it must be able to keep up with the many real-time events taking place si-

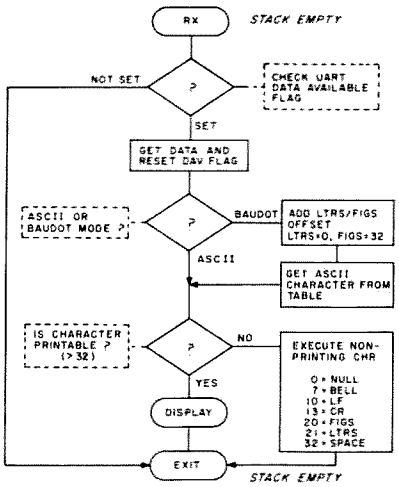


Fig. 8. The receiver module (RX).

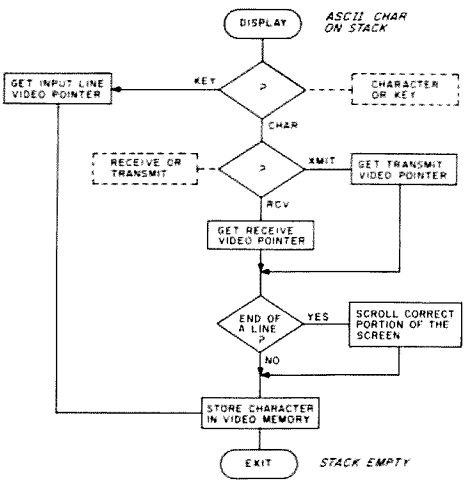


Fig. 10. The display module (DISPLAY).

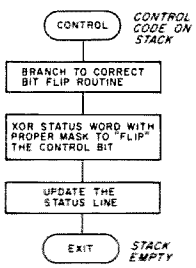


Fig. 9. The control module (CONTROL).

multaneously. A slower language may have to resort to interrupt routines in some key areas. Forth is fast enough that it can handle everything "on the fly."

The program consists of six main modules. These are named CI, TX, RX, CONTROL, DISPLAY, and TRANSMIT. CI is the command interpreter. TX is the routine that constructs the data byte to be transmitted. RX decodes the received byte and either displays it or executes some function. CONTROL accepts a control character from the keyboard and performs the requested action, such as changing baud rates, activating automatic unshift on space, etc. DISPLAY handles the printing of characters on the video monitor and the line printer. And finally, TRANSMIT keeps track of which buffer transmit data is stored in and taken from.

The heart of the program is the command interpreter, or CI (see Fig. 6). All program functions begin and end here. CI's main task is to accept input from the keyboard and to take some action based on it. If no key is present, the routine examines a flag to see if we are currently transmitting data. If we are, it transfers control to TX to see if it is ready to send another character. If we're not transmitting, control is transferred to RX to see if it has a received-data byte for us. Both of these routines process one character at a time and then return to CI.

If CI detects a key input, it gets the key data and decides what to do with it. Certain control codes may be transmitted, so these are passed to TRANSMIT for placement in the current buffer. Other control codes tell the program what we would like to do, such as turning the printer on or off, changing the transmit buffer pointer, etc. These are passed to the CONTROL module. If the key data is not a control character, then it is passed directly to TRANSMIT which stores it in the current buffer for TX to send when its turn comes.

TX checks the current buffer pointer to see if there is anything for it to send—see Fig. 7(a). If there is not, it simply returns to CI. However, if there is, a number of things happen. First, we must check a flag to see if the intended transmission should be in Baudot or ASCII. If it's ASCII, we simply send it on its way since that's the way we stored it in the buffer. But if it's Baudot, we have some work to do first. We must look at the character and decide if it's a letter or figure. Once this is decided, we send the proper shift, if necessary, and then convert the ASCII character to its equivalent Baudot code. Finally, we send it on its way through the ether to the fellow ham anxiously awaiting it on the other end of the QSO. This is done by checking our UART for a "transmit buffer empty" condition and, when it's ready, simply storing the data byte at E500 hex. The UART then converts it to serial data and sends it to the 2ICTU where it is converted to the proper audio tones for transmission by your ham station. We also simultaneously show it on the transmitted-text portion of the video monitor and print it on the printer if so desired.

When RX (Fig. 8) is called by CI, it first looks at the UART status register to see if a received character is ready. If not, it exits immediately back to CI. If it does find the data-available flag set, it gets the character from E502 hex and then resets the DAV flag by writing to E503 hex. RX now checks to see how it is to interpret this data byte. It must first decide if it's ASCII or Baudot. If it's Baudot, we must determine if it is a letter or figure, then convert it to the correct ASCII code. Now we have to determine if it's a control character or a printable character. If it's control, we take the appropriate action, and if not, we pass it to the display module. The display routines print it in the received-text portion of the video screen and, if hard copy is desired, on the printer.

CONTROL (Fig. 9) accepts legal control codes and sets the desired parameters to direct the decisions required of all the other routines. It does this by maintaining a 16-bit status word which is used by the other modules. Each bit of the status word represents a control function's current status. The other modules simply have to examine this status word to decide how they are to perform. All control functions are "toggle type." This means that they can be accessed at any time during program execution since all we have to do is "flip" them. The next time the bit is examined, the proper adjustment in operation is made. I am currently using only 7 of

FSK Demodulator Parts List

1	EXAR 2211 FSK demodulator IC		$ 3.95
1	2N2222 NPN transistor		.17
2	1N4148 diode		.14
1	LED		.20
1	2k 10-turn trimmer	(All Jameco parts except	1.19
1	5k 10-turn trimmer	Radio Shack generator.)	1.19
1	1k-Ohm resistor		.06
1	5.8k-Ohm resistor		.06
1	8.2k-Ohm resistor		.06
2	10k-Ohm resistor		.12
1	15k-Ohm resistor		.06
1	60k-Ohm resistor		.06
1	100k-Ohm resistor		.06
1	120k-Ohm resistor		.06
2	520k-Ohm resistor		.12
2	.0015-uF mylar capacitor		.30
1	.022-uF mylar capacitor		.13
2	.022-uF mylar or polystyrene		.26
1	.01-uF mylar		.12
3	.1-uF mylar		.81
1	14-pin socket		.43
1	SPDT switch		1.49
1	8-Ohm to 1000-Ohm audio transformer		1.29
1	2N3905 PNP transistor (or 2N3906)		.20

FSK Generator Parts List

1	EXAR 2206 function generator		$ 3.95
1	2N2222 NPN transistor		.17
1	1N4148 diode		.07
2	10k trimmer		2.20
1	100k trimmer		1.10
1	5k 10-turn trimmer	(All Jameco prices.)	1.19
2	2k 10-turn trimmer		2.38
1	220-Ohm resistor		.06
1	3k-Ohm resistor		.06
1	6k-Ohm resistor		.06
2	7.5k-Ohm resistor		.12
1	15k-Ohm resistor		.06
1	27k-Ohm resistor		.06
1	56k-Ohm resistor		.06
2	1-uF tantalum capacitor		.58
2	.0222-uF mylar™ or polystyrene cap		.24
1	.1-uF mylar capacitor		.27
1	SPDT switch		1.49
1	16-pin socket		.47
1	Enclosure of your choice		—
1	12-V-dc power supply		—

the 16 available bits. Bit zero is used as a letters/figures flag by the transmit routines. Bit 1 indicates that the buffer mode is engaged. Bit 2 determines line or word mode. Bit 3 activates the Baudot unshift on space feature. Bit 4 is used to control the printer. Bit 5 is the receive/transmit indicator, and bit 6 tells us if we're in ASCII or Baudot mode. In addition, there are control inputs to choose the transmit buffer and to change the baud rate. The last thing CONTROL does before returning to CI is to update the status line at the top of the video monitor. This line always shows the current status of all switches and activities.

The DISPLAY module (Fig. 10) receives characters from the other modules and prints them in the proper location on the video monitor, and on the line printer if so requested. My system uses memory-mapped video so that it was relatively simple to set up the split-screen display. If you use a serial terminal, you will have to write a display module to suit your hardware. My screen is split into four sections. The top line is the status line, as mentioned before. It is displayed in reverse video so that it will stand out. This is followed by a blank line and then 8 lines of receive space. Beneath the receive space is another blank line and then 4 lines that display data as it is being transmitted. The very bottom line is the transmit-buffer input line.

In use, you simply select the operating mode you desire and then have fun. While in receive mode, you can watch text as it comes in and type your response into one of the transmit buffers to send when your turn comes. I have 3 buffers on my system, but more can easily be added. I have one large one (500 bytes) for general text and two smaller ones for specific information such as QTH, rig, etc. The transmit-buffer pointer is circular which means that typing the key to increment the pointer to the next buffer eventually gets you to the one you want. The status line keeps you informed as to which one is active. You can then either fill that buffer or send it as desired. When your turn comes to transmit, you simply type a control T to start sending. You can continue to type text into the buffer at the same time using either line or word mode. Corrections to your text can be made at any time prior to entering the key that causes it to be transferred to the buffer. You will see your transmitted text appear on the video just as it is being sent. All controls are always available to you at any time during operation of the program. This makes for quite convenient operating.

That pretty well covers the 2ICTU and the RTTY software that makes it perform. This was a very rewarding project from both the hardware and software standpoints. The modular approach to both also provides a very flexible system, one which can grow and change as desired. I will be glad to respond to any questions or comments if you will be so kind as to include an SASE.

I think you will find the 2ICTU a very convenient way to try the fascinating world of radioteletype without spending too many of those hard-earned dollars. Even if you are not interested in the 2ICTU, the serial port has many other uses, such as driving printers, modems, and the like. 73. ■

Serial Port Parts List

1	1602 or equal UART		$ 4.95
2	74LS00 IC 6 and 7		.50
1	74LS02 IC 8		.25
2	74LS04 IC 4 and 5		.50
1	74LS30 IC 9		.29
1	74LS42 IC 10	(All Jameco prices.)	.55
1	74LS86 IC 11		.39
3	74LS367 IC 1, 2, and 3		1.47
1	4742 zener diode		.23
1	7805 voltage regulator		1.35
1	heat sink		.39
1	100-uf electrolytic 16 V		.24
1	1-uF tantalum 35 V		.29
6	.1-uF ceramic bypass		.48
1	SPDT switch		1.49
7	14-pin WW sockets		3.15
4	16-pin WW sockets		2.76
1	40-pin WW socket		1.99

Miscellaneous connectors and cable wire-wrap card to suit your system

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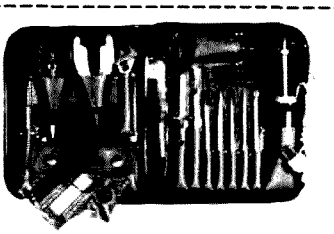
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—Fred Blechman, K6UGT

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

SOUTH BEND IN
JAN 5

A hamfest will be held on January 5, 1986, at Century Center, on US 33 North between the St. Joseph Bank Building and the river, downtown South Bend IN. Table space is $1.00 per foot. Talk-in on .52/.52, .99/.39, .93/.33, .69/.09, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616; (219)-233-5307.

WAUKESHA COUNTY WI
JAN 11

The West Allis Radio Amateur Club will sponsor the Midwinter Swapfest on Saturday, January 11, 1986, beginning at 8:00 am, at the Waukesha County Expo Center Forum. Take I-94 to Co. F, south to FT, and west to Expo. Admission is $2.00 in advance and $3.00 at the door. Four-foot tables are $3.00 in advance, $4.00 at the door. For tickets or more information, send an SASE to WARAC Swapfest, PO Box 1072, Milwaukee, WI 53201.

VA STATE FAIRGROUNDS
JAN 12

The Richmond Amateur Telecommunications Society will sponsor the ninth annual Richmond Frostfest on Sunday, January 12, 1986, from 8:30 am to 3:30 pm, at the Virginia State Fairgrounds. Admission is $4.00. Flea-market spaces are $4.00; $8.00 with an 8-foot table. VEC exams will be held on Saturday. For more information, write the Richmond Frostfest, PO Box 1070, Richmond VA 23208, or call Bill Scruggs N4DDM at (804)-272-8206.

OAK PARK MI
JAN 12

The Oak Park ARC will sponsor a radio swap on Sunday, January 12, 1986, from 7:30 am to 4:00 pm, at Oak Park High School, 14300 Oak Park Boulevard, Oak Park MI 48231. For more information, contact David Lefko WB8RGQ, 875 S. Pontiac Trail #103, Walled Lake MI 48088.

HOSARC 13TH
JAN 19

The Hall of Science Amateur Radio Club will operate special-event stations using the call WB2JSM on January 19, 1986, from 1500 to 2100 UTC, to commemorate HOSARC's thirteenth anniversary. SSB operation will be in the first 25 kHz of the 40-, 20-, 15-, and 10-meter General phone bands. CW operation will be in the first 25 kHz of the 80-, 40-, 15-, and 10-meter Novice bands and in the first 5 kHz of the 30-meter band. For a commemorative certificate, QSL with a large SASE (44 cents or 1 IRC) to HOSARC QSL Manager, Arnie Schiffman WB2YXB, 81-22 250th Street, Bellrose NY 11426.

YONKERS NY
JAN 26

The Yonkers Amateur Radio Club will hold an electronics auction on Sunday, January 26, 1986, from 9:00 am to 3:00 pm, at Lemko Hall, 556 Yonkers Avenue, Yonkers NY. Admission is $3.00; children under 8 are free. Inspection is from 9:00 am to 10:00 am and the auction will begin at 10:00 am. Talk-in on 146.865/R, 440.150/R, and 146.52. For more information, contact the YARC, 53 Hayward Avenue, Yonkers NY 10704; (914)-969-1053.

SOUTHFIELD MI
JAN 26

The Southfield High School ARC will hold its 20th annual Swap and Shop on January 26, 1986, from 8:00 am to 3:00 pm, at Southfield High School, 24675 Lahser, Southfield MI. Admission is $2.50. Two 8-foot reserved tables are $20.00. Each additional table is $10.00. For more information, write Robert Younker, Southfield High School, 24875 Lahser, Southfield MI 48034.

TEACHER IN SPACE
JANUARY

The Concord Brasspounders ARC will operate W1OC to commemorate Christa McAuliffe's teacher-in-space flight of the space shuttle. Operation will be from 1300 UTC on Saturday to 1259 UTC Sunday during the first weekend following the launch of the shuttle with Christa aboard. Anticipated launch date is January 22, 1986. Suggested frequencies are: phone—7.285, 14.285, 21.385; CW—7.050, 14.050, 21.050; Novice—7.105. For a certificate, send an SASE to W1OC, PO Box 2214, Concord NH 03301.

BATTLE OF KWAJALEIN AND ROI-NAMUR
FEB 1-10

The Kwajalein Amateur Radio Club will operate special-event station KX6BU from 0600 UTC on February 1, 1986, until 0600 UTC on February 10, 1986, to commemorate the 42nd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies will be: SSB—28.550, 21.350, and 14.250; CW—28.050, 21.050, 14.050, and 7.025. For $6.00, stations working KX6BU will be issued a certificate, a QSL, and a 64-page book describing the Battle of Kwajalein and Roi-Namur. $3.00 will bring a QSL and a certificate. All requests should be sent to: KX6BU, Box 444, APO San Francisco 96555-008.

PUNXSUTAWNEY PHIL
FEB 2

The Punxsutawney Amateur Radio Club will operate special-event station KA3CUY on Sunday, February 2, 1986, beginning at 9:00 am EST, to commemorate Groundhog Day 1986. Frequencies are 3.950 and 7.230 MHz ± QRM. KA3CUY will carry a recording of the official proclamation for the next 6 weeks' weather (as determined by Punxsutawney Phil). For a certificate, send a QSL and a large SASE to PARC, RD 5, Box 14, Brookville PA 15825.

ST. CATHARINES ONT
FEB 8

The Niagara Peninsula ARC will hold its annual hamfest and flea market on Saturday, February 8, 1986, beginning at 8:00 am, at the UAW Hall, Bunting Road, St. Catharines, Ontario. Talk-in on 147.240/.840. For more information, contact NPARC, Box 692, St. Catharines, Ontario LR2 6Y3, Canada.

MARLBORO MA
FEB 16

The Algonquin ARC will hold its annual hamfest/electronic flea market on Sunday, February 16, 1986, beginning at 10:00 am, in the Marlboro Junior High School cafeteria. Admission is $1.00. Tables are $7.50 in advance and $10.00 at the door. Seller setup begins at 8:30 am. Talk-in on .01/.61 and .52. For reservations or more information, contact the AARC, PO Box 258, Marlboro MA 01752; (617)-393-9920.

SPOONER WI
FEB 16

The Wild Rivers ARC will hold its midwinter swapfest on Sunday, February 16, 1986, from 10:00 am to 3:00 pm, at the Spooner Experimental Farm, east of Spooner WI on Highway 70. Exams will be given. Tables are available. Talk-in on 147.81/.21. For more information, contact Tom Young KD9FC, Route 5, Box 5239, Hayward WI 54843.

MANSFIELD OH
FEB 16

The Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 16, 1986, beginning at 7:00 am, at the Richland County Fairgrounds, Mansfield OH. Admission is $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Talk-in on 146.34/.94 (W8WE). For tickets or more information, contact Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905; (419)-589-2415 after 3:00 pm EST.

FRIDLEY MN
FEB 22

The Robbinsdale ARC will sponsor the fifth annual Midwinter Madness Hobby Electronics Show on February 22, 1986, from 7:00 am to 2:00 pm, at Totino-Grace High School, 1350 Gardena Avenue NE, Fridley MN. Admission is $3.00 in advance and $4.00 at the door. 8-foot tables are $8.00; 1/2 tables are $4.00. Exams will be given. Talk-in on 147.60/.00 (K0LTC) and .52 simplex. For more information or to register, contact the Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354.

GLASGOW KY
FEB 22

The Glasgow Swapfest will be held on Saturday, February 22, 1986, beginning at 8:00 am, at the Glasgow Flea Market Building, two miles south of Glasgow KY, just off Highway 31E. Admission is $2.00; no extra charge for exhibitors. The first table is free, and each additional table is $3.00. Talk-in on 146.34/.94. For more information, contact Mike Goad N4HCO, Route 4, Box 354, Glasgow KY 42141.

CHICOPEE MA
MAR 2

The Mount Tom Amateur Repeater Association will hold its annual flea market on March 2, 1986, from 8:00 am to 3:00 pm, at the Knights of Columbus Elder Council 69, Granby Road, Chicopee MA. Admission is $1.00; ladies and children under 12 are free. Tables are $7.00 in advance and $8.00 at the door. For more information, contact MTARA, PO Box 3494, Springfield MA 01101.

ST. LOUIS MO
MAR 14

The Jefferson Barracks ARC will sponsor its 26th annual amateur-radio auction on Friday, March 14, 1986, beginning at 7:30 pm, at Concordia Turners Hall, 6432 Gravois, St. Louis MO. For more information, contact the Jefferson Barracks ARC, 1624 Union Road, St. Louis MO 63125.

FORT WALTON BEACH FL
MAR 15-16

The Playground ARC will hold its 16th annual North Florida Ham/Swapfest on Saturday and Sunday, March 15-16, 1986, at the fairgrounds, Fort Walton Beach FL. Admission is $3.00; XYLs and children are free. Tables will be available. Talk-in on 146.19/.79. For more information, contact Hud Huddleston KF4BU, 925 Forest Avenue, Fort Walton Beach FL 32548; (904)-862-2566.

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LETTERS

WISE UP

I just read Rick C. Wilson's letter, "I Hate Code" (*73*, March, 1985). I wonder if Rick would hate the code so much if he knew that by passing a few code tests (he says he already knows a lot about electronics) he could command a cushy job on a world-ranging freighter.

I wonder how much he would hate the code if a military conflict should rear its ugly head.

Sure, it's tough to apply your butt to a hard chair and try to copy the stuff when it's dot for dot and dash for dash. Once it gets learned, though, it opens up a whole new world. Get yourself wised up, Mr. Wilson.

Paul L. Schmidt W9HD
Bloomfield IN

STOP HIDING

I love my simplex autopatch. There, I said it and I'm glad. Now that it's out of the closet, let the other hams enjoying this delightful device stop hiding and not feel guilty in its use.

I fully realize that the incorrect use of simplex autopatch (on, say, 2 meters) can lead to an abuse of our privileges, but I feel that the proven maturity of licensed amateur-radio operators will prevail and it will be used properly.

A lot of misunderstanding, traced to cliquish repeater groups who found their uniqueness in offering patches, is now ended. They may feel that this privilege shall only belong to them—how dare an individual try to bypass them!

I'm tired of reading of the restrictions in advertising that the manufacturers of simplex devices must follow, and above all, I dislike the reluctance of the ham fraternity to openly discuss their use.

Answering the phone while driving is as much fun as DXing, contesting, or any other facet of our hobby. Besides, we are only using one frequency versus the repeater using two. With the BSR touchtone™ appliance controller, I can call my phone and have the unit shut off, thus satisfying FCC requirements.

Don't put restrictions on its use. There is enough room in the spectrum for everybody.

Mike Herbstman KM2F
New York NY

RE DISPLAY REPLAY

I cannot help but wonder what Roger Grandbois ("Letters," October, 1985) was trying to prove. Mr. Grandbois, manufacturer of digital display systems, was so determined to belittle the "What You See is Where You're At" frequency-display project (*73*, July, 1985) that he overlooked the more obvious virtues of the project. To me, it seems apparent that the purpose of the project was to provide the experimenter/builder with an inexpensive solution to the problem of display resolution as opposed to the purchase of a more advanced receiver or commercial display adapter. The prescribed project executes this task like a champ. Nevertheless, Mr. Grandbois insists on stating the obvious shortcomings of the project while espousing his own product.

As presented, the July '85 project does exhibit change in sidebands and will only work on single-mix superheterodyne receivers. True, these problems exist. But with the use of moderate circuit additions, the frequency display will find a place in more complicated applications. It is a fair assumption that any experimenter with a reasonable understanding of radio receivers will arrive at the same conclusion. Carl Anderson ("Letters," October, 1985) provided us with a modification of the display's counting direction. This modification furthers the applications of Mr. Miller's project. Undoubtedly, some other ingenious Gus will engineer additions that will beat the aforementioned technical problems.

I was inspired and taught by radio amateurs of the "old school." That is the practice of construction and experimentation. Mr. Miller provided a fine construction article of a very practical project. My fellow radio builders will agree.

Mark Foltarz KA4JVY
Tampa FL

Mark—Good news! Thomas Miller has designed a "universal" version of his display. Look for it in an upcoming issue of 73.—KW1O.

MORE! MORE!

I was fascinated by Victor Layton's article, "Above Intercept," in the October, 1985, issue. I was a flight-control officer at Watton during the time the event took place.

The 25th Bomber Group was a most unusual group in the 8th Air Force. Besides the undercover work that Layton wrote about, we also helped to perfect blind-bombing techniques, LORAN, and Mickey. We did photo and weather reconnaissance and were pathfinders for bomber missions. If there was anything secretive to be done, I'm sure we did it. (As a small point of digression, I should state that President Roosevelt's son, Elliott, was our commanding officer.)

I wrote to Mr. Layton and sent him a lot of history and information about the 25th Bomber Group at Watton, and he sent back a nice reply. I'm sure he could tell many more exciting stories. "Above Intercept" was a departure from the usual technical articles and brought back a feeling of nostalgia. More! More!

William Bernstein KA2OVR
Great Neck NY

FULL ADVANTAGE

If we are to attract new people to amateur radio, we need to be able to demonstrate that we know how to use the privileges that we have to our full advantage. One improvement that would benefit the beginner would be to establish a national CW calling frequency in the middle of the 10-meter Novice band, 28.150 MHz.

Henry J. Hampel KA0TUP
St. Louis MO

TO K7UGA:

Dear Senator Goldwater:

I share your concerns over the declining (and aging) amateur-radio population, and I agree with your proposed alternatives to a no-code license; these proposals are echoed almost everywhere in the ham literature.

What bothers me is that two critical points have not yet (to my knowledge) been addressed. Without careful consideration of these points, we may be solving the *wrong* problem, and we may be doing irreparable harm to amateur radio as a result.

1. I keep hearing that the average age of a licensed amateur-radio operator is near 46, and that it is increasing more than one year, each year.

Averages, by themselves, can be very misleading. I have never seen a standard deviation, nor have I seen a comparison to a population of non-hams with the same sexual, geographic, and economc distributions. I'm not a statistician, but would these data show us that hams are actually increasing their population relative to the one above? Would these data perhaps illuminate the reasons for decline? Why am I the only ham asking these questions?

2. The problem is not limited to amateur radio: Robert Burnham said (see "Forum," September, 1985, *Astronomy Magazine*), "If we don't get the children interested in astronomy, there'll be no next generation of astronomers." Within the last six months, *Live Steam Magazine* (a voice of model steam-engine enthusiasts) published bar charts and graphs based on profiles of club members' records from around the country. The projections (don't let the oily fingernails fool you; their presentation was the best I've seen) clearly showed that they were in a dying hobby if something wasn't done about it, and pretty soon.

I am writing to you, Senator, and sending copies to every major amateur-radio publication because I want my concerns to be considered by a majority of hams *before* we make changes to our hobby.

I believe we may make a hasty, disastrous change to amateur radio unless we examine *our* problem more closely, and examine *the* problem more carefully.

Alex Vrenios KX9I
Mundelein IL

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

SATELLITES REVISITED

I'm reluctant to admit this, but I think that I'm becoming something of an audio voyeur. In a way, I think most hams are. After all, shortwave listening is nothing more than audio voyeurism, and "copying the mail," be it on a repeater or on the HF bands, falls into the same general category.

But I believe I've probably taken audio voyeurism to its ultimate limit. As regular "Fun!" readers know, a few months ago I acquired a satellite-TV system. After a few weeks of watching Peruvian-rules football, music videos in Esperanto, and Dr. Gene Scott, I began to yearn for something a bit more esoteric. It was at that point that I discovered the world of SSB on C-band satellites.

A friend told me that if I hooked a good-quality communications receiver, like my Kenwood R-100, to the baseband output of my satellite receiver, I could pick up all sorts of interesting signals transmitted on SSB. The sort of signals, my friend claimed, that are far more interesting than the exploits to be found each evening on F4, 12. Better yet, he said, each transponder offers 36 MHz of frequency space. Yes, friends, 36 MHz on some 16 satellites, each with approximately 24 transponders. That's equivalent to 384 HF spectrums!

This is where my audio voyeurism comes in. As you probably know, most long-distance telephone calls are transmitted by satellite these days. What you may not know, however, is that many of the satellites used are the same ones that home satellite installations receive. Therefore, a satellite earth station connected to an SSB receiver results in a lot of interesting listening.

The Communications Act of 1934, as amended, prohibits listeners from divulging the contents of telephone communications. However, if you happpen to accidentally tune across these signals, as I often do, and you happen to hear some really juicy conversations, as I often do, there isn't very much the FCC can do about it. After all, as a radio amateur, I have a definite need to tune across the complete spectrum of most satellite transponders, and if in the course of my technical explorations I happen to hear some heavy breathing going on, it isn't my fault. Let MCI, AT&T, and the others scramble their transmissions, I'm going to continue my experimentation. I'll keep quiet, but I'll keep listening.

So there you have it. Audio voyeurism taken to its limit. As for me, I'm just waiting for Picturephone to make its grand return (heh-heh).

ELEMENT 1 MULTIPLE CHOICE

1) How wide is a standard US baseband video signal?
   1) 4.0 MHz
   2) 4.2 MHz
   3) 14 MHz
   4) 40 MHz

2) Satellite receivers typically use GaAsFET transistors. The acronym GaAsFET stands for:
   1) Gallium Arsenide Field Effect Transistor
   2) Gallic Arsenic Field Effect Transistor
   3) Germanium Arsenide Field Effect Transistor
   4) Gas Arsenic Field Effect Transistor

3) In a satellite receiver, a phase-locked-loop (PLL) circuit is often used as:
   1) a video enhancement circuit
   2) a low-noise amplifier
   3) a composite video generator
   4) an FM demodulator

4) DOMSATs:
   1) are operated by AT&T
   2) are operated by RCA
   3) are operated by COMSAT
   4) is a generic term for domestic satellites

5) Name the *73* Magazine columnist who founded his own national TV system on the Turks and Calcos Islands.
   1) Bill Gosney
   2) Chod Harris
   3) Robert Baker
   4) Bob Cooper

ELEMENT 2
TRUE-FALSE

	True	False
1) A satellite's "footprint" refers to its signal strength at various points on the earth's surface.	____	____
2) The "look angle" is the angle above the horizon at which a satellite signal arrives at an earth station's location.	____	____
3) Geosynchronous satellites are immobile.	____	____
4) "Shrouding" is a synonym for "dish."	____	____
5) "Sky noise" is a type of man-made interference.	____	____
6) "Adaptive deviation multiplex" is a satellite video format.	____	____
7) Teletext and videotex are usually transmitted on the vertical blanking interval (VBI) of a satellite-TV signal.	____	____
8) US satellites can only transmit NTSC video.	____	____
9) In microwave reception the term "TI" usually stands for "terminated interconnect."	____	____
10) Dishes roughly two meters in diameter are routinely used for video reception.	____	____

ELEMENT 3
SCRAMBLED WORDS

Unscramble these words relating to satellites:

POMRCAATRO	RRRBUSCAIE
HOFNEERD	RATSLET
PACES	KAIN
ROCAS	BRITO
OORRT	RETDOWNNREVOC

ELEMENT 4
FILL IN THE BLANK

1) "Sun outages" occur _____ a year.
2) Small dishes have a _____ beamwidth.
3) Large dishes have a _____ beamwidth.
4) The driven element in a microwave antenna can also be called a _____.
5) One uses a _____ to convert a satellite's microwave signal to a VHF frequency.

THE ANSWERS

Element 1:
1—2, 2—1, 3—4, 4—4, 5—4.

Element 2:
1—True If you're outside of the footprint, you can't receive the satellite's signal.
2—True And where you point your antenna.
3—False They move at 7,000 miles per hour, the same rate at which the earth rotates.
4—False Walls or screens around a dish that prevent side interference.
5—False Microwave radiation that comes from deep space.
6—False It's a method used for transmitting stereo audio signals.
7—True It's those little white dots you see on the black line between the picture frames.
8—False They can also handle PAL, SECAM, and the rest.
9—False Terrestrial interference.
10—False Usually for data or audio reception.

Element 3:
(Reading from left to right): COMPARATOR, SUBCARRIER, FEEDHORN, TELSTAR, SPACE, ANIK, OSCAR, ORBIT, ROTOR, DOWNCONVERTER.

Element 4:
1—twice
2—wide
3—narrow
4—probe
5—downconverter

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each correct answer.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Two and one-half points for each correct answer.

How did you do?
1-20 points— Beyond the horizon
21-40 points— Suffering from a sun outage
41-60 points— Minimal reception
61-80 points— Some sparklies
81-100 points— Closed-circuit copy

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73 AWARDS

Bill Gosney KE7C
2665 North Busby Road
Oak Harbor WA 98277

It's hard to believe the years which have passed since our initial announcement of the famous *73* Awards Program portfolio. Since its introduction by yours truly, KE7C, in 1979, we've seen the program grow to become one of the most sought-after challenges facing amateurs today!

Consisting of six domestic and five DX operating achievements, the program has captured the interest of rag-chewers, DXers, and contesters alike.

The requirements for each award are not as easy as one might first imagine. Once you qualify for an award, you know for sure you've earned it. Here are the five DX awards:

DX COUNTRY CLUB AWARD

1. Available to licensed amateurs and SWL stations worldwide.

2. To be valid, all claimed contacts must be made in a single calendar year (January 1 through December 31), beginning January 1, 1979.

3. This award is issued for phone, CW, and mixed-mode. Should the applicant wish to recognize a single-band or mixed-band accomplishment, he must state his preference when making application.

4. A minimum of 73 DX countries must be worked and confirmed from the *73* Magazine WTW (Work the World) DX Listing.

5. Annual endorsement stickers are available for each succeeding year in which application is made and a minimum of 73 DX countries are worked.

6. To apply, prepare a list of claimed contacts in prefix order. Include each station's callsign, date and time of contact in UTC, mode, and band of operation.

7. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

8. Award fee is $5.00 for each award. Do not send IRCs or foreign currency. Endorsements are granted for a fee of $2.50. Checks on foreign banks must be payable in US funds.

9. Forward your application and fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

DX CAPITALS OF THE WORLD

1. This award is made available to licensed amateurs and SWL stations throughout the world.

2. All claimed contacts must be made on or after January 1, 1979. There are no band or mode restrictions. Special recognition will be given for single band or mode if requested at the time application is made.

3. To qualify, applicants must work and confirm a minimum of 50 different national capital cities in the world. Only capital cities of those countries appearing on the WTW DX listing qualify. Should a country be contacted and its capital city not commonly be known, go ahead and list it in your application. The awards editor reserves the right to make a final determination.

4. To apply, make a list of contacts in prefix order. Indicate the station callsign, date and time in UTC, band and mode of operation, the name of the national capital city, and the DX country.

5. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

6. Award fee is $5.00 and must be payable in US funds. IRCs or foreign currency can no longer be accepted.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

TEN-METER DX DECADE AWARD

1. The 10-Meter DX Decade Award is made available to licensed amateurs and SWL stations worldwide.

2. All contacts must be made on the 10-meter band using only low-power (20 Watts of output or less) equipment. External amplifiers may not be used.

3. To be eligible, all contacts must be made on or after October 1, 1978. Contacts may be made on AM, SSB, CW, or 10-meter FM. Mixed-mode contacts may also be claimed. Crossmode contacts do not qualify.

4. To qualify, a minimum of ten DX countries must be worked from the WTW DX Listing. Endorsements will be given for 25, 50, 75, and 100 confirmed countries.

5. To apply, prepare a list of claimed contacts in prefix order. include the callsign of each station worked, the date and time in UTC, band, mode, and a brief description of the equipment used in making each contact.

6. *Do not send QSL cards.* Have your application verified by two amateurs or a notary public.

7. Award fee is $5.00 in US funds only. Sorry, we cannot accept IRCs or foreign currency. Endorsements are $2.50 each.

8. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD (CLASS A-1)

1. This is made available to licensed amateurs and SWL stations throughout the world.

2. To be eligible, all contacts must be made on or after January 1, 1979. Only communications via SSTV, RTTY, EME (Earth-Moon-Earth), and/or OSCAR will be recognized for award credit. Contacts between stations on OSCAR and EME may be made using the mode authorized in your country. Mixed-mode contacts are not valid, however.

3. To qualify, applicants must work a minimum of ten DX countries from the WTW DX Countries Listing. Special recognition will be made for those exceeding the ten-country minimum.

4. To apply, prepare a list of claimed contacts in callsign prefix order. Include the date and time in UTC, the band and mode of operation, and a description of your equipment and antenna system used to make the contacts.

5. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

6. The award fee is $5.00 in US funds only. IRCs or foreign currency is not acceptable. Foreign checks must be payable in US funds.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD (CLASS A)

1. Available to licensed amateurs and SWL stations throughout the world, this award requires all contacts be made on or after January 1, 1979.

2. Only communications via SSTV, RTTY, EME (Earth-Moon-Earth), and/or OSCAR satellite will be recognized for this award. Contacts between stations on OSCAR and EME may be made using any authorized mode allowed in your country. Mixed-mode contacts are not valid.

3. To qualify, applicants must work and confirm contact with each of the 50 US states. There are no band requirements. Specific band accomplishments will be recognized, however, if requested at the time application is made.

4. To apply, the applicant must prepare a list of claimed contacts in alphabetical order by state. Include the date and time in UTC, the band and mode of operation, and a description of the equipment and antenna system used.

5. *Do not send QSL cards.* Have your list verified by two amateurs or a notary public.

6. Award fee is $5.00 in US funds only. Sorry, we cannot accept IRCs or foreign currency.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Man-

WORK THE WORLD DX LISTING

AFRICA

A2	Botswana
C5	Gambia
C9	Mozambique
CN	Morocco
CN2	Tangier
CR3	Guinea Bissau
CT3	Madeira Is.
D2, 3	Angola
D4	Republic of Cape Verde
D6	Comoros
EA8	Canary Islands
EA9	Ceuta and Melilla
EA9	Ifni
EA9	Rio de Oro
EL	Liberia
ET2	Eritrea
ET3	Ethiopia
FB8W	Crozet
FB8X	Kerguelen Is.
FB8Z	Amsterdam & St. Paul
FH	Mayotte
FR	Glorioso Island
FR	Juan de Nova, Europa
FR	Reunion
FR	Tromelin
H5	Bophuthatswana
IG	Lampedusa Island
IH	Panteileria Is.
J2, FL8	Djibouti
S7	Seychelles
S8	Transkei
S9	Sao Tome and Principe
ST	Sudan
ST0	South Sudan
SU	Egypt
TJ	Cameroon
TL	Central African Empire
TN	Congo
TR	Gabon
TT	Chad
TU	Ivory Coast
TY	Benin
TZ	Mali
VK0	Heard Island
VQ9	Aldabra Island
VQ9	Chagos (Diego Garcia)
VQ9	Desroches
VQ9	Farquhar
XT	Upper Volta
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Gough Island and Tristan de Cunha
ZE, Z2	Zimbabwe
ZS1, 2, 4, 6	South Africa
ZS2	Prince Edward Island
ZS2	Marion Island
ZS3	Southwest Africa (Namibia)
3B6, 7	Agalega & St. Brandon
3B8	Mauritius
3B9	Rodriguez Island
3C	Equatorial Guinea
3C0	Annobon
3D6	Swaziland
3V	Tunisia
3X	Republic of Guinea
3Y	Bouvet Island
5A	Libya
5H	Tanzania
5N	Nigeria
FR	Malagasy Republic
5T	Mauritania
5U	Niger
5V	Togo
5X	Uganda
5Z	Kenya
6O	Somali
6W	Senegal
7P	Lesotho
7Q	Malawi
7X	Algeria
8Q, VS9	Maldive Islands
9G	Ghana
9J	Zambia
9L	Sierra Leone
9Q	Republic of Zaire
9U	Burundi
9X	Rwanda

EUROPE

C3	Andorra
CT	Portugal
CT2, CU	Azores
DA-DL	Federal Republic of Germany
DM, DT, Y2-9	German Democratic Republic
EA	Spain
EA6	Balearic Islands
EI	Republic of Ireland
EJ0	Aran Is.
F	France
FC	Corsica
G	England
GD	Isle of Man
GI	Northern Ireland
GJ, GC	Jersey
GM	Scotland
GM	Orkney Oslands
GM	Shetland Islands
GU, GC	Guernsey
GW	Wales
HA	Hungary
HB	Switzerland
HB0	Liechtenstein
HV	Vatican
I	Italy
IC	Ischia
IA	Tuscan Archipelago
IS	Sardinia
IT	Sicily
JW	Bear Is.
JW	Svalbard Is.
JX	Jan Mayen
LA	Norway
LX	Luxembourg
LZ	Bulgaria
M1, 9A	San Marino
OE	Austria
OH	Finland
OH0	Aland Is.
OJ0	Market Reef
OK	Czechoslovakia
ON	Belgium
OY	Faeroe Islands
OZ	Denmark
PA	Netherlands
SM	Sweden
SP	Poland
SV	Greece
SV	Crete
SV	Dodecanese
SV	Mount Athos
TF	Iceland
UA, UK1, 3, 4, 6	European RSFSR
UA1, UK1	Franz Josef Land
UA2, UK2F	Kaliningradsk
UB, UK, UT, UY5	Ukraine
UC2, UK2	White RSFSR
UO5, UK5O	Moldavia
UP2, UK2B, P	Lithuania
UQ2, UK2G, Q	Latvia
UR2, UK2R, T	Estonia
YO	Romania
YU	Yugoslavia
ZA	Albania
ZB	Gibraltar
1A0	Sov. Mil. Order of Malta
3A	Monaco
4U	ITU, Geneva
9A	(See M1)

OCEANIA

A3	Tonga Republic
CR8	Portuguese Timor
C2	Republic of Nauru
DU	Philippines
FK	New Caledonia
FO	French Polynesia
FW	Wallis & Fortuna Islands
H4, VR4	Solomon Islands
JD, KA1	Minami Torishima
JD, 7J1	Okino Torishima
KB, KH1	Baker, Howland, American Phoenix
KC6	Eastern Carolines
KC6	Western Carolines
KG6, KH2	Guam Island
KG6R, KH0	Rota
KG6S, KH0	Saipan
KG6T, KH0	Tinian
KH6	Hawaiian Islands
KH7	Kure Island
KJ, KH3	Johnston Island
KM, KH4	Midway Island
KP6, KH5K	Kingman Reef
KP6, KH5	Palmyra
KS6, KH8	American Samoa
KW, KH9	Wake Island
KX	Marshall Islands
P2	Papua New Guinea
T2, VR8	Tuvalu Island
VK	Australia
VK	Lord Howe Island
VK9	Willis Island
VK9	Christmas Island
VK9	Keeling, Cocos Island
VK9	Mellish Reef
VK9	Norfolk Island
VK0	Macquarie Island
VR1, T31	British Phoenix Islands
VR1, T30	Gilbert Island
VR1, T30	Ocean Island
VR3	Christmas Island
VR3, T32	Line Island
VR6	Pitcairn Island
VR7	Line Island, South and Central
VR8	(See T2)
VS5	Brunei
YB, YC, YD	Borneo
YB, YC, YD	Celebes
YB, YC, YD	Java
YB, YC, YO	Sumatra
YB, YC, YD	West Irian
YJ	New Hebrides
ZK1	North Cook Island
ZK1	South Cook Island
ZK2	Niue Island
ZL	New Zealand
ZL	Auckland & Campbell
ZL	Chatham Island
ZL	Kermadec
ZM7	Tokelaus
3D2	Fiji Islands
5W	Western Samoa

ASIA

A4X	Oman Is.
A5	Bhutan
A6	United Arab Emirates
A7	Qatar
A9	Bahrain
AP	Pakistan
BV	Taiwan
BY	China
CR9	Macao
EP	Iran
HL, HM	North Korea
HL, HM	South Korea
HS	Thailand
HZ, 7Z	Saudi Arabia
JA-JR	Japan
JR6, KA6	Okinawa (Ryukyu Is.)
JD, KA1	Ogasawara
JT	Mongolia
JY	Jordan
KA	US Military in Japan
OD	Lebanon
S2	Bangladesh
TA	Turkey
UA, UK, UV, UW9-0	Asiatic RSFSR
UD6, UK6C, D, K	Azerbaidzhan
UF6, UK6F, O, Q, V	Georgia
UG6, UK6G	Armenia
UH8, UK8H	Turkoman
UI8, UK8I	Uzbek
UJ8, UK8J, R	Tadzhik
UL7, UK7	Kazakh
UM8, UK8M, N	Kirghiz
VS6	Hong Kong
VS9K	Kamaran Is.
VU	India
VU7	Andaman & Nicobar
VU7	Laccadives
XU	Kampuchea
XV	Vietnam
XW	Laos People's Dem. Rep.
XZ	Burma
YA	Afghanistan
YI	Iraq
YK	Syria
1S	Spratly
4S	Sri Lanka
4W	Yemen
4X, 4Z	Israel
5B4, ZC	Cyprus
7O	People's Dem. Rep. of Yemen
8Z4	Neutral Zone Saudi Arabia/Iraq
9H	Malta
9H4	Gozo & Comino
9K	Kuwait
9M2	West Malaysia
9M6	North Borneo
9M8	Sarawak
9N	Nepal
9V	Singapore
	Abu Ali, Jabal Attair

NORTH AMERICA

C6	Bahamas
CO, CM	Cuba
FG	Guadeloupe
FG, FS	Saint Martin
FM	Martinique
FO	Clipperton Is.
FP	St. Pierre & Miquelon
HH	Haiti
HI	Dominican Republic
J3, VP2G	Grenada & Dependencies
KC4, KP1	Navassa Is.
KG4	Guantanamo Bay
KL7	Alaska
KP4	Desecheo
KP4	Puerto Rico
KS4, KP3, HK0	Serrana Bank & Roncador Cay
KV, KP2	Virgin Islands
OX, XP	Greenland
PJ6, 8	Saba Is.
VE	Canada
VE1	Sable Is.
VE1	St. Paul Is.
VO	Newfoundland, Labrador
VP2A, V2	Antigua, Barbuda
VP2D, J7	Dominica
VP2E	Anguilla
VP2K	St. Kitts
VP2L, J6	St. Lucia
VP2M	Montserrat
VP2S, J8	St. Vincent & Dependencies
VP2V	British Virgin Islands
VP5	Turks and Caicos Islands
VP9	Bermuda
W, K, N, A	United States of America
XE	Mexico
XF4	Revillagigedo Islands
ZF	Grand Cayman Islands
6Y	Jamaica
4U	HQ, United Nations
8P	Barbados

SOUTH AMERICA

CE	Chile
CE0A	Easter Is.
CE0X	San Felix
CE0Z	Juan Fernandez
CP	Bolivia
CX	Uruguay
FY	French Guiana
HC	Ecuador
HC8	Galapogos Is.
HK	Colombia
HK0	Bajo Nuevo
HK0	Malpelo Is.
HK0	San Andres & Providencia
HP	Panama
HR	Honduras
HR0	Swan Is.
KZ	Canal Zone
LU	Argentina
OA	Peru
PJ	Bonaire
PJ	Netherlands Antilles
PY	Brazil
PY0	Fernando de Noronha
PY0	St. Peter & St. Paul
PY0	Trinidade & Martim Vaz Is.
PZ	Surinam
TG	Guatemala
TI	Costa Rica
TI9	Cocos Is.
VP1, V3	Belize
VP8	Falkland Is.
VP8, LU	South Georgia Is.
VP8, LU	South Orkney Is.
VP8, LU	South Sandwich Is.
VP8, LU	South Shetland Is.
VP8W	South Grahamland
YN, HT	Nicaragua
YS	Salvador
YV	Venezuela
YV0	Aves Is.
ZP	Paraguay
8R	Guyana
9Y	Trinidad and Tobago

ager, 2665 N. Busby Road, Oak Harbor WA 98277.

WORK THE WORLD DX AWARD

To enhance the enjoyment of working DX, the editors of *73* take special pleasure in introducing the most complex and probably one of the most sought-after DX awards available today—the Work the World DX Award.

1. The WTW Award is available to licensed amateurs and SWL stations worldwide.

2. To be valid, all contacts must be made on or after January 1, 1979. There are no band or mode restrictions. Special single-band or -mode achievements may be recognized if you make your request the same time application is made.

3. The Work the World program consists of six individual continental awards (North American, South American, European, Oceanic, Asian, and African), each of which is a worthy single accomplishment by itself. To be eligible for the 7th and ultimate award (the WTW Award), applicants first earn the continental recognition. Once all six awards have been applied for, the WTW award will be issued at no charge to the applicant. The operator who earns WTW recognition has truly "worked the world."

4. Requirements for the individual continental awards: North American Award—a minimum of 13 North American countries; South American Award—12 South American Countries minimum; European Award—a minimum of 12 European countries; African Award—12 African countries minimum; Asian Award—12 Asian countries minimum; Oceanic Award—a minimum of 12 Oceanic countries.

5. To apply, prepare a list of claimed contacts for each continent. List contacts in prefix order. Include the date and time in UTC and the band and mode of operation.

6. If you are submitting your sixth continental award, please alert the award manager to this fact.

7. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or a notary public.

8. Each continental award is $5.00 in US funds only. We are sorry, but we can no longer accept IRCs, or foreign currency. Checks written on foreign banks must be payable in US funds.

9. Forward your application(s) and fee(s) to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

Now here are the six domestic awards also being sought after by award seekers throughout the world. These awards are not meant to be an overnight venture and they were designed to not duplicate any in existence today. Each offers its own degree of difficulty and creates a sense of accomplishment.

ANNUAL WORKED ALL USA AWARD

1. If you're looking for a stateside award with a challenge, the USA Award is definitely the one. The annual Worked All USA Award is available to licensed amateurs and SWL stations throughout the world.

2. To qualify, applicants must work each of the 50 US states within the same calendar year (January 1 through December 31). Annual endorsements will be awarded each subsequent year to applicants who verify their claim.

3. All valid contacts must be made on or after January 1, 1979. There is an award for single-band accomplishments on 2, 6, 10, 15, 20, 30, 40, 75, and 160 meters. A mixed-band award is also available.

4. To apply, prepare a list of claimed contacts in alphabetical order by state. List the state, the callsign of the station worked, the date and time in UTC, and the band and mode of operation.

5. *Do not send QSL cards.* Have your list of contacts verified by two amateurs or by a notary public.

6. The fee for this award is $5.00 in US funds. Annual endorsements are $2.50. We are sorry but we can no longer accept IRCs or foreign currency. Checks written on foreign banks must be payable in US funds only.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

THE Q-5 AWARD OF EXCELLENCE

If you frequent the American Novice bands, you will be pleased to learn of this award. This award is not meant to be an overnight accomplishment. Stations meeting the challenge of this award will be proud to display it in their shacks. It depicts the excellence and superiority of a station's transmitted signal as it is heard throughout the various US call districts.

1. The Q-5 Award is available to licensed amateurs and SWL stations throughout the world.

2. To qualify, applicants must work all ten US call districts and receive no less than a Q-5 readability report. A valid RST might be 599, 579, 549, etc., while an RST of 459, 449, or 469 would not qualify.

3. To be valid, all contacts must be made operating CW on those frequencies assigned the American Novice. Contacts must be made on or after January 1, 1979.

4. There are no band restrictions; however, applicants may request special band endorsement at the time application is made.

5. To apply, prepare a list of claimed contacts, logging each one in order of US call district worked. Include the station callsign, date and time in UTC, the frequency, and most importantly, the RST as noted on the confirmation card.

6. *Do not send QSL cards.* Have your list verified by two amateurs or a notary public.

7. Award fee is $5.00 in US funds. No IRCs or foreign currency. Checks written on foreign banks must be payable in US funds.

8. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

DISTRICT ENDURANCE AWARD

If any of you feel our awards are too easy for you, take a hard look at this award! Looks simple, huh? Don't be deceived. Try pursuing it; it will drive you right up the wall with frustration.

For the District Endurance Award, you'll need to find yourself an accurate timepiece, as you'll have exactly 60 minutes to work all ten US call districts. If you surpass the time limit, you'll have to start all over again. It definitely takes some planning; perhaps even some band changing.

Oh, one last important point. All contacts must be made independent of nets and net-type operations and must not be made while a contest is underway! Any takers?

1. The District Endurance Award is available to licensed amateurs and SWL stations worldwide.

2. To be valid, all contacts must be made on or after January 1, 1979. There will be no band or mode restrictions. If you are fortunate to work all contacts on a single band, however, we will be happy to recognize that feat if you mention it at the time application is made.

3. To qualify, applicants must work all ten US call districts in one hour or less. The time will commence the moment the first contact is established (callsign and RST is exchanged) and ends the moment the 10th call-district contact is made. Call districts can be worked in any order so long as all ten districts are worked within the 60-minute period.

4. To apply, applicants must state in their applications that all contacts were made independent of net or contest operation. Applicants must prepare a list of claimed contacts in callsign order by district. Include the date and time in UTC, the band and mode of operation, and the state.

5. *Do not send QSL cards.* Have your claimed list of contacts verified by two amateurs or a notary public.

6. Award fee is $5.00 and must be payable in US funds. No IRCs or foreign currency. Checks written on foreign banks must be payable in US funds only.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

TEN-METER 10-40 AWARD

What would an awards program be without a stateside QRP incentive? Designed especially for owners of converted CB equipment, the 10-40 Award is probably the roughest worked-all-states award in existence. If you don't believe it, ask those who've tried numerous times and failed.

1. This award is available to licensed amateurs and SWL stations throughout the world.

2. To be valid, all contacts must be made on the ten-meter band using low power (20 Watts of output or less.) External amplifiers are prohibited. Contacts must be made on or after October 1, 1978, on AM, SSB, CW, or FM. Crossmode contacts will not count.

3. To qualify, applicants must work and confirm at least 40 US states.

4. To apply, make a list of contacts made in alphabetical order by US state beginning with Alabama. Include the call of the station worked, the date and time in UTC, the mode of operation, and a brief description of the equipment and antenna system utilized to make the contacts.

5. *Do not send QSL cards.* Have your list verified by two amateurs or a notary public.

6. Award fee is $5.00 in US funds. IRCs and foreign currency are not acceptable. Checks written on foreign banks must be in US funds only.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277.

CENTURY CITIES AWARD

Designed as a dual worked-all-states effort, *73* presents the Century Cities Award. The applicant who has earned this recognition has accomplished probably the greatest feat available in WAS award programs.

1. Sponsored by *73* Magazine, this award is available to licensed amateurs and SWL stations throughout the world.

2. All contacts must be made on or after January 1, 1979, to be valid.

3. To qualify, the applicant must work and confirm a minimum of two cities or towns in each of the 50 US states, for a total of 100.

4. To apply, prepare a list of contacts in alphabetical order *by state.* Include the callsign, the date and time of the contact in UTC, the band, and the city.

5. *Do not send QSL cards.* Have your claimed contact list verified by two amateurs or a notary public.

6. Award fee is $5.00 in US funds. Do not send IRCs or foreign currency, as they are no longer acceptable. Checks written on foreign banks must be payable in US funds.

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How does *73* process award applications? Upon receipt of an application, each entry is carefully scrutinized for authenticity. They must be sent to the Awards Manager in the proper format as noted in the award rules.

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We hope you enjoy the challenges of the *73* awards program. We ask that you share it with your amateur friends.

REVIEW

YAESU FT-209RH HANDIE-TALKIE

I needed a new 2-meter radio. My trusty Kenwood TR-7730 had been sold a year ago to help pay for a new car, and I had since saved up enough money to get back into VHF. But I needed something different. A full-featured radio with scanning, *memories*, DTMF pad, and the like was preferred.

Since I also travel by air a lot, I wanted a radio I could run around with without having to lug around a rig and big power supply. Also, having been bit by the packet bug, I needed a way to monitor the local digipeater (only fair since it had my call on it).

The obvious solution seemed to be one of the new generation of moderate-power (5 Watts), computer-controlled handie-talkies. *You know the kind I'm talking* about—the ones with the fancy keyboards and the digital ashtrays. I never really had a very high opinion of these units. To me, an HT was supposed to be a basic transceiver with a few crystal-controlled channels (or a thumbwheel-selected synthesizer) to be used as a status symbol at swapfests or for monitoring a few frequencies. These new units struck me as, well, wimpy. I also remember the terrible reliability problems these units had when

they first hit the market a few years back. Now they had to be considered.

As I started my search for a full-featured HT at one of the recent area ham conventions, I found I had more than enough reason to be skeptical. Looking down the aisles of the exhibitors' hall, I saw most of the wearers of one brand looking like Leaning Towers of Pisa because the units were so heavy on their belts. Another rig had some nice features but ran on a screwy voltage: An adaptor had to be purchased to run the thing off 12 V. Still another HT looked great and was the next model up from a very popular basic HT, but the only place I saw them was at the exhibitors' table because none of the distributors could get them imported!

Then I ambled over to the Yaesu booth and saw their FT-209RH.

Inside the Box

Your hard-earned cash buys you the radio, a soft case, a rubber ducky antenna, a standard-size battery pack, and a wall charger as standard equipment. Major options include a speaker/mike, headset/mike, several styles of charger/dc-supply combinations, battery packs (including one that holds six AA-size dry cells), and a tone-squelch (i.e., PL™) encoder/decoder. I decided to get a speaker/mike and a couple of extra battery packs with my unit. All told, I spent a shade under $400 for the package.

Physically, the business end of the FT-209RH (*sans* battery pack) is almost exactly the same size as the ICOM 2A/AT without its battery pack (I use the 2AT for comparison here because they are so common—almost everyone has at least seen one). With a standard-size battery pack on both units, the Yaesu is maybe a half inch taller. Weight is also close, the Yaesu, with the standard battery pack, being heavier by a small, but noticeable margin. The two units are virtually identical in size and weight when using a smaller battery pack on the 209. The 209 is also noticeably thinner and lighter when compared to its older brother, the FT-208.

The rubber ducky is ordinary, with a BNC connector. The carrying case is a rather flimsy plastic affair. It covers the 209's display with clear plastic but leaves the keyboard "out in the open" with a cut-out section. And it fits worse than a Joliet Special.

Batteries

The standard battery pack runs 12 V and is rated at 500 mAh, producing 5 W from the transmitter. An available smaller NiCd pack runs 10.8 V at 425 mAh and reduces the transmitter's output to about 3.5 W. The dry-cell pack reduces transmitter power to about 2.5 W.

The battery charger that comes with the 209 is a small wall transformer type. It's a trickle charger, taking about 15 hours to charge the standard NiCd pack fully. It *cannot* be used to charge the smaller pack; a separate charger is required. Yaesu offers a drop-in charger that will charge either NiCd pack in under 1.5 hours (then maintain the charge on trickle) and simultaneously operate as a dc supply.

The NiCd packs themselves have two small sockets (of different types so they can't be connected incorrectly) and four metal plates on the bottom. One socket is for dc (the HT will accept 6-15 V dc) direct to the radio. A circuit in the battery pack regulates the proper voltage to the HT. The other socket is for battery charging. The small plates on the bottom of the pack are used with the drop-in charger. The dry-cell pack is just a simple holding case. There are no connections underneath, therefore it is not possible to run a 12-V-dc supply through it like the NiCds.

Receiver

This is a pretty hot little receiver for a handie-talkie. Less than .1 uV was enough to break the squelch with an intelligible signal. Sensitivity was measured at .18 uV for 12 dB Sinad, 1 uV for 30 dB S + S/N.

Unfortunately, the good sensitivity seems to have lowered the 209's immunity to intermod somewhat. Subjectively, the unit seems to be more susceptible than other HTs, especially when connected to a base-station antenna.

Selectivity came in at −6 dB for ± 7.5 kHz and −60 dB for ± 15 kHz.

Transmitter

The transmitter section will produce a good solid 5 Watts on high power with the 500-mAh (12-V) battery. A 13.8-V-dc supply will squeeze out a bit more. The manual says the low-power mode will run 500 mW, but my unit runs 700 mW. Low power output is adjustable, but a maintenance manual is pretty much required to find the spot.

The transmiter output is also very clean. Spurious transmissions are down over 70 dB and the second harmonic is −60 dB from the carrier frequency. Tested with a 1000-Hz tone, deviation runs a little over 4.7 kHz. Touchtones™ from the keyboard deviate about 3.3 kHz, just right for most repeater autopatches.

I had quite a scare while making the second-harmonic measurement mentioned above. The spectrum analyzer used for making the measurement showed the display shown in Photo B. It appeared that the second harmonic was only 30 dB below the carrier frequency. Hardly a sparkling specification! I called for a "second opinion." Sure enough, the second device showed a very respectable −60 dB. Turns out a notch filter was needed with the original analyzer. A lesson to be learned for all those making test measurements!

Functions

Make no mistake, the FT-209RH can do a lot of things. Ten memories. Priority channel. Calling channel. Programmable tone squelch (with the tone option). A *zillion* scanning modes. In fact, there are so many functions that it can take a while to learn all the commands! Even Yaesu doesn't know everything it can do: They concede the point in the last paragraph in the owner's manual.

There are controls on literally every side of the 209, including behind and even underneath! The top of the unit holds the usual volume and squelch controls, high/low power switch, sockets for external mike and speaker, and VOX controls (used with the optional headset/mike). Two minor gripes: There are no plugs to seal the mike and speaker sockets when not used, and the VOX switches are "active," even when there is no VOX headset/mike connected. Accidentally activating the VOX switch will cause a VOX-delayed end of transmission after releasing the PTT switch (neither the internal mike nor the optional speaker/mike will operate in a VOX mode).

A master reset button is located in a tiny recessed hole on the back of the HT. Pushing a small pointed object like a pin into the hole while the 209 is turned on will reset the radio's functions. This is the "boy, I really screwed something up" button.

Another small button *underneath* the radio sets the smallest scan step. The battery pack must be removed for access and, like the reset button, a small pointed object must be inserted.

The PTT button is located on the left side of the radio. A momentary-contact lamp button on the right side illuminates the LCD display and signal-strength meter for viewing in low-light conditions.

Front Keyboard

There are three main uses for the keyboard: to transmit DTMF tones, to enter frequencies, and to access HT functions. All the keys except the F (Function) key have two functions.

While the 209 is transmitting, the keyboard will act as a 16-digit DTMF encoder. The usual numbers * and # are marked on the keyboard. The auxiliary tones are accessed with the I (down arrow), M, D, and F buttons.

The keyboard is used for entering frequencies, either for direct selection or for loading into memory. Frequencies are entered from the lowest MHz on down, terminated by hitting the D (for dial) button. For example, entering 6025D would set the frequency to 146.025 MHz. All four digits need not be entered: Pressing 65D will set the HT to 146.500 MHz. Note that nothing happens until that D button is pushed. The next logical step in frequency selection is entering an offset if a repeater will be used. Selecting an offset (+ or −) will shift the transmitter 600 kHz, or any other desired offset selected with the Shift (Function then Reverse keys) function. The Reverse key allows monitoring of a repeater input or "upside-down" operating. The selected offset will remain even if the dial frequency is changed.

The selected frequency and offset (and even a selected subaudible tone frequency with the optional tone module) may be placed into one of the ten memory channels by pressing the desired channel number (0–9) followed by the M key. Memory frequencies are recalled by pressing the channel number followed by the MR key. Memory channel 0 may be recalled instantly with just the * key. Yaesu suggests this channel be set to a calling frequency.

There may be more ways to scan frequencies with an FT-209RH than you can possibly use. The entire band may be scanned. The memories may be scanned. The band between two memory channels may be scanned. You can manually scan. There is auto stop on busy channels (with auto resume), and auto stop on clear channels (with auto resume). You can operate on a dial frequency while monitoring a memory channel or mask memory channels so they won't be scanned at all. Sheesh! Scanning is initiated using the up- and down-arrow keys (↑ and ↓), with the type of scanning (manual, stop-on-clear, or stop-on-busy) selected with a small slide switch on the lower edge of the keyboard, and the mode of scanning depending on whether a dial frequency or memory channel is currently displayed.

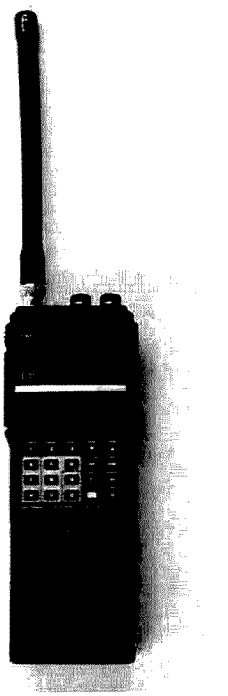


Photo A. Yaesu's FT-209RH.

There are several controls that are intended for the operator rather than the radio (or at least aren't related to either of the two topics above). Slide switches control the function of the signal/battery-level indicator and a keyboard lockout. A "beep" on keypress may be turned on or off. But by far the mode that really makes me want to jump up and down and shout "oh boy, this is great!" is the battery-save feature. When the 209 is in the save mode,

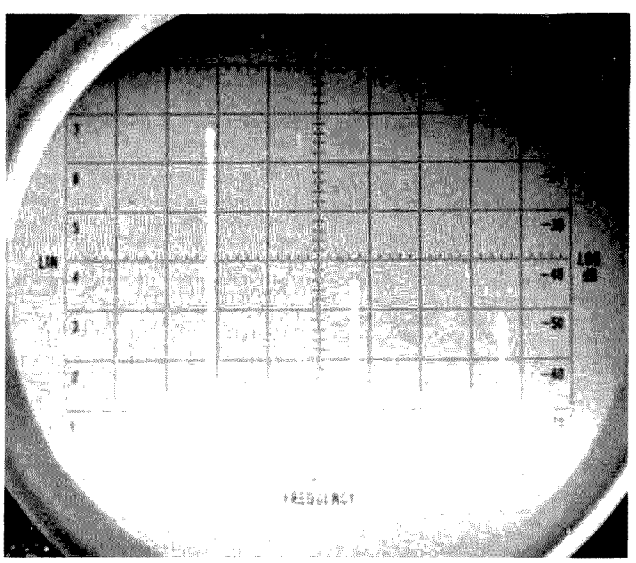


Photo B. What's wrong with this display?

the HT will shut off the receiver circuits and almost everything else except some timers and related stuff for a front-panel-selected amount of time, up to three seconds. It will then reactivate for 300 ms to see if there is receiver activity. If not, it goes "back to sleep" for another cycle. If there is activity, the mode will stand by until the channel is quiet for at least five seconds, when it will start again. Current drain in the save mode is a miniscule 6 mA! Given a 500-mAh battery, it is possible to monitor for several *days* without changing batteries.

Unfortunately, the save mode will not work during scanning, although it is possible to effectively monitor two frequencies in the save mode by using the radio's "priority channel" function. The function switches the receiver from a dial frequency to a selected memory channel for 300 ms every 5 seconds under normal conditions. In the save mode the frequency will alternate between the dial frequency and the memory channel every time the receiver "wakes up."

Some Final Thoughts

It takes a while to memorize all of the commands available to someone using an FT-209RH. For me, the learning curve was much longer for the 209 than for other radios I have used. Some of the commands may be unnecessarily complex. I think Yaesu could have made the 209 much more user-friendly. For example, the VOX functions could have been put in a less prominent place than the top of the unit. A PTT button lock would have been nice, too.

I've touched only the major functions of the FT-209RH. I could probably go on for another couple of pages if I were to describe all the possible permutations. Suffice it to say that during normal operation, very little extra work is required. Once everything is set, there's not much reason to change anything. And judging from on-the-air reports, this HT "sounds good."

I did run into a problem which could only be attributed to a lapse in quality control. The transmitter would mysteriously cut out if the HT was held a certain way or if it was shook. Opening the unit (not for the faint of heart), I found the cause to be a wire not properly soldered to the antenna connector's center conductor. To be fair to Yaesu, I should point out that the times I needed to speak to someone at their Ohio Service Center I was treated promptly and politely.

All that said, I still really like the FT-209RH. After all the commands are mastered, it is a very versatile, powerful unit. It can do everything a base-station rig can do, and then some. The memories and some of the memory-scan functions are particularly useful. The battery-save feature is something that should be in every HT...I'm spoiled now. Borrow somebody's Yaesu FT-209RH for a few days and take it for a test run. But be sure to ask for the owner's manual, too.

I'd like to thank Steve KE5O, Paul WA5JMZ, and Chris WB5ITT for their comments, suggestions, and help in the preparation of this review.

For more information, contact *Yaesu Electronics Corp., 6851 Walthall Way, Paramount CA 90723; (213) 633-4007.*

Mark Herro WB9LSS
Beaumont TX

```
1 - Microvolts/dBM Conversions
2 - Frequency/Wavelength Conversions
3 - System Received Signal Levels
4 - Gain of Parabolic Antenna
5 - Propagation Calculations
6 - Return to DOS
```

Fig. 1. Main menu from "Radio System Calculations."

HORSE SENSE SYSTEM DESIGN SOFTWARE

I recently had an opportunity to evaluate "Radio System Design Calculations" and "Radio Interference Analysis," two new software packages from Gerald Townsend at Horse Sense Software. Both are available for several microcomputers and both cost about $35.00, depending upon your particular configuration. I tried them out on an IBM PCjr with an RGB monitor and an Okidata Microline 93 printer.

Radio System Design Calculations

This package is a collection of conversion programs and calculations designed to save wear and tear on your pencil. Five major categories may be selected from a main menu (see Fig. 1), and each category consists of one to six subprograms. All of the programs are menu-driven and I found the instructions to be clear and presented in a logical order (a big shortcoming for many programs of this type!).

I felt that only three of the five programs in the main group were useful—Frequency/Wavelength Conversions, System Received Signal Levels, and Propagation Calculations. Of the remaining two categories, Gain of Parabolic Antennas is the most trivial. Simple formulae like the one for parabolic gain are best evaluated by hand or on a scientific calculator, not by a program running on an $800 computer. Microvolts/dBm Conversions, my other pan, just wasn't useful in my application; the program is quite handy if you need to change dBm to microvolts into various impedances.

Normally, I would have included Frequency/Wavelength Conversions on my list of trivia, but after a few test runs I was convinced of its utility. It's a simple matter to use the familiar 492/frequency to get the half wavelength of a dipole in free space, but this routine gives you *everything* you need to know, including the half and quarter wavelengths for two common coaxial cables, and it does it much faster than a calculator.

Propagation Calculations and System Received Signal Levels are the other two winners in the package. The first will grind out facts about any radio site you can devise, including path loss between sites, distance to real and radio horizons, and required antenna heights for a given horizon. Combine these parameters with the Signal Levels program (which produces a microvolts-at-the-receiver value for a given receiver and signal path) to get the answer to questions like, "How will raising my repeater's antenna by ten feet affect the repeater's performance?" and, "What coverage will a new repeater site give?" It seemed a *bit tedious* hopping back and forth between programs, but it actually took only a second or less.

Radio Interference Analysis

This software design tool was designed specifically for the land-mobile site planner and is not as practical for amateur use as "Radio Systems Design Calculations." It consists of two modules, one for intermodulation analysis and the other for image-response analysis. The two modules share a common database which contains transmitter/receiver information for a particular site (such as an amateur repeater installation which coexists with commercial users). Site files are built and saved in a simple step-by-step fashion, and there are ample opportunities to review and revise your entries.

The Intermodulation analysis program uses a two-pass process for either 3rd- or 5th-order products. The first pass considers two transmitters operating at the same time and the second looks at three transmitters. In both instances *all of the* products produced by the hypothetical mixing of the transmitted frequencies are checked against each receiver's frequency. Products which fall within a specified receiver susceptibility range (the default is 30 kHz) are flagged and sent to the printer. Fig. 2 is a sample 5th-order three-transmitter printout which was generated by a site file included on the program diskette. The number-crunching took about four minutes and the program executed about 135,000 calculations.

The image-response section compares all of the transmitters in the site file against a receiver with a user-specified receive and I-f frequency. Again, problems are flagged and sent to the printer. Both high-side and low-side injection schemes are considered.

A tutorial mode may be selected from the main menu which steps the user through all of the input and output of the intermodulation analysis. Output is sent to the screen rather than to the printer, and changing values and parameters is made extremely simple. This mode is an excellent way to get the "feel" of the program and learn a bit about intermodulation products in the process.

Last Thoughts

Both "Radio System Design Calculations" and "Radio System Interference Analysis" are well-documented, and the latter includes long sections discussing various methods of site management and a thorough review of basic intermodulation product calculations. I think that "Interference" will not make a big splash on the amateur scene, but I do recommend it to repeater owners and coordination bodies as a useful tool in repeater-site preparation and management. "Design Calculations," on the other hand, has several handy features that make the package well worth $35.

The two programs are available on disk (and tape, in some cases) for the Apple II, Commodore 64, IBM PC and PCjr, Kaypro II, and Radio Shack's Color Computer, Model 3/4, and Model 2/16. Contact *Horse Sense Software, PO Box 214, Gardiner MT 58030* for current prices and formats.

Perry Donham KW1O
73 Staff

```
**********************************************************************
*** Three transmitter - 5th Order products falling within the specified
    Susceptability range of + or - 30 Khz.

Transmitters involved/products                  Users & Freq. affected.

 2X 165.5875 -2X 164.8 + 164.825 = 166.4        NPS 1--- 166.375 MHz.
 2X 165.5875 -2X 164.8 + 164.825 = 166.4        NPS 2--- 166.375 MHz.
 2X 164.125 -2X 164.825 + 166.975 = 165.575     NPS 3--- 165.5875 MHz.
 2X 164.125 -2X 164.825 + 166.975 = 165.575     NPS 4--- 165.5875 MHz.
 2X 417.475 -2X 417.375 + 166.975 = 167.175     NPS 5--- 167.15 MHz.
 3 X 165.5875 - 164.8 - 164.825 = 167.1375      NPS 5--- 167.15 MHz.
 3 X 164.8 - 163.125 - 164.125 = 167.15         NPS 5--- 167.15 MHz.
 2X 417.475 -2X 417.375 + 166.975 = 167.175     NPS 6--- 167.15 MHz.
 3 X 165.5875 - 164.8 - 164.825 = 167.1375      NPS 6--- 167.15 MHz.
 3 X 164.8 - 163.125 - 164.125 = 167.15         NPS 6--- 167.15 MHz.
 2X 164.125 -2X 166.975 + 417.375 = 411.675     NPS A LINK--- 411.675 MHz.
 2X 164.125 -2X 166.975 + 417.475 = 411.775     NPS B LINK--- 411.775 MHz.
 2X 164.8 -2X 165.5875 + 166.375 = 164.8        USFS F1--- 164.825 MHz.
 3 X 165.5875 - 164.8 - 167.15 = 164.8125       USFS F1--- 164.825 MHz.
 2X 164.8 -2X 165.5875 + 166.375 = 164.8        USFS F2--- 164.825 MHz.
 3 X 165.5875 - 164.8 - 167.15 = 164.8125       USFS F2--- 164.825 MHz.
```

Fig. 2. Sample 5th-order intermodulation analysis.

TEL MK-800 MEMORY KEYER

A few years back, the state of North Carolina created a large industrial park at the center of the triangle formed by Raleigh, Durham, and Chapel Hill. It became known as the Research Triangle Park. The park was supposed to encourage old businesses to move in and new ones to form. One of the newer businesses is Triangle Electronics Laboratories. A ham-oriented business, they recently came out with the MK-800, which they claim is the most cost-effective digital memory keyer on the market. Having had the opportunity to use one, I heartily agree.

The MK-800 was billed as a "complete memory keyer designed for the experienced contest operator as well as the Novice." While not a Big Gun contester, I have participated in several using a simple, home-brew digital keyer. I felt that I was ready to move up into the world of memory keying and was able to give the MK-800 a shakedown during the 1985 ARRL DX contest.

The unit arrived from TEL packed in a sturdy cardboard box and was cushioned with foam peanuts. Nothing unusual about that, but the end of the power cord was wrapped in its own cushioning layer to keep it from scratching the keyer's case. That was a touch that I'd never seen before and it hinted of a good attention to detail. An eleven-page, spiral soft-bound manual came with the keyer.

Ignoring the manual, just for the moment, I examined the MK-800. It was a compact, two-tone plastic package. The front-panel layout was esthetically quite pleasing. There has been a bad trend lately towards making everything look as if it was either army surplus or crammed with millions of front-panel buttons that only a gnat could push. The MK-800, on the other hand, has a clean, functional, yet friendly look. In the upper center there is an LED display window housing two easy-to-read red LEDs. The upper left corner is home to the sending-speed control. Across the bottom, eight square push-button switches give you control over the most frequently used operating functions. The feel of the switches is very good, very solid, with just the right amount of feedback. Red LEDs over each switch convey information to the user. The switches and knobs are labeled with a pleasant style that is easy to read from a normal operating distance. The unit's colors, black, white, and grey, are arranged in such a way as to give it some personality, yet they allow it to harmoniously blend with almost any station.

So it was a nice paperweight, but was it any good as a keyer? I began to hook it up. Turning it over, I examined the rear panel. Across the top of the machine there are (from left to right) the sidetone switch, a +12-volt jack, a remote-control jack, and the key, paddle, and transmitter relay jacks. Across the bottom we have the power switch and the sidetone tone and volume adjustments.

It was time to consult the manual. A quick scan found that page 2 had a description of the required connections. The paddle input wanted a 1/4-inch stereo phone plug with the tip as dits, the center as dahs, and the shield common. Since that was the same setup as my home-brew keyer, I was able to use my existing cable. (The MK-800 does not come with any cables or connnectors, so be ready for a trip to Radio Shack unless you get lucky, as I did.) I also noticed that the paddle inputs are TTL-compatible, so the unit could be controlled by a home computer.

The transmit relay is a fast reed relay. It is wired so that it floats relative to the MK-800's chassis ground. This allows it to be

safely plugged into just about any kind of rig. The keyer end requires another 1/4-inch stereo phone plug. The tip and the center are the relay contacts, while the shield is connected to the MK-800 chassis ground. I made up a cable with connectors and hooked the keyer to my rig.

Checking the connections, I powered up the MK-800 and my rig (a Swan 350). Since I was operating at home, I ran the unit off the standard 110-volt-ac mains. The inclusion of a 110-volt power supply, as well as a +12-volt input, is another example of Triangle Electronics Laboratories bucking a bad trend. All too often we see reasonably priced rigs with exorbitantly priced "optional" power supplies. It seems that many manufacturers expect us to run our equipment off good karma.

When the power switch was on, the MK-800 performed a dramatic power-up test. The indicator LEDs lit up, the two big numeric LED displays started displaying numbers, and finally the unit beeped. It was so much fun to watch that I turned the power off and on again. When the self-test was finished, the numeric display had a "00" on it, indicating that the keyer was ready to go. So I squeezed the paddles and was rewarded with a clean-sounding string of dits and dahs. The MK-800 does not have any transmitting weight adjustments. Instead, it sends according to the recognized standard of one dah being three dit lengths long. The dit length is set by the front-panel speed control. The keyer is iambic, sending alternating dits and dahs when both paddles are squeezed. It also has a 1-dot or -dash memory and is self-completing.

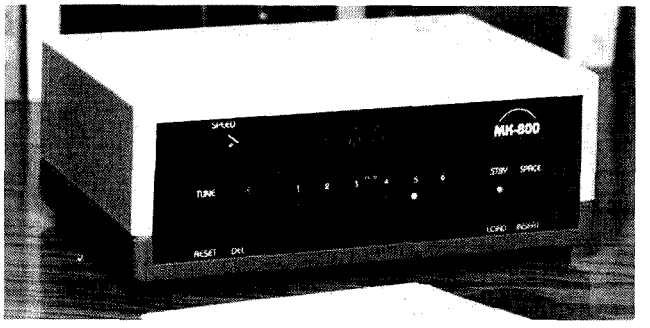
So far it functioned like my home-brew keyer. It was time to try out some of the advanced features. First I took the opportunity to adjust the tone and volume of the sidetone. These adjustments are done on the back of the unit and require a small screwdriver to turn the miniature potentiometers. This would be inconvenient except that these adjustments almost never need changing once they are set.

Flipping through the manual, I found the section labeled "Function Switches." Unfortunately, although there is a good deal of text for each switch, it is unclear and difficult to read. However, it seemed to be saying that all I had to do was press the load switch followed by a memory-select switch and the keyer would load the memory with what I was sending. So I did, and sure enough, it worked. It was much easier than the manual made it out to be, as were all the other functions. It appears that the folks at TEL are great engineers but could use some technical writers.

The MK-800 has six memories. Each memory will hold up to 99 characters. Memories are loaded by pushing the load button, followed by a memory-select button. The large numeric display shows the number of characters entered and is incremented each time a new character is sent to the keyer. When the entire message has been entered, you tell the keyer you are finished by pushing the reset button or any of the memory-select buttons. If you push the reset button the keyer just stops loading and goes back into dumb-keyer mode with your message in memory. If you push a memory-select button the keyer begins sending the contents of the selected memory.

Memory number six is special. It can be configured (via jumpers) to send a three-digit serial number. The leading zeros can be suppressed and all zeros can be sent as the letter O. The serial number can be pre-loaded, automatically incremented, or automatically repeated. Or, if you want, it can be left as a plain memory.

Ninety-nine characters make quite a long message. It doesn't take much familiarity with statistics to calculate the chances of sending a message that long without errors. Fortunately, the MK-800 has provisions for human fallibility. When the inevitable error occured, I was ready, having already read about the delete button. Each time this switch is pressed, the last character in the memory is deleted. Loading resumes at the place that was occupied by the deleted character.



The MK-800 memory keyer from Triangle Electronics Laboratories.

Once the message was loaded, I pushed the memory-select button. The keyer immediately began sending my message, while the display showed a countdown of the number of characters left to send. Pushing the pause button once stopped the transmission when the current character finished. While the unit was paused, I could send code manually with the paddles. Pushing the pause button a second time allowed the message to continue to completion.

When the message was completely sent, the LEDs displayed "00." I pushed the memory-select button a second time, repeating my test message. This time I tried out the break-in function. While the message was going out, I began sending with the paddles. The keyer Immediately stopped its transmission and gave me control of the transmitter relay. While the Swan 350 does not have a break-in feature for CW, it was nice to see that the keyer could handle it.

I was ready to go on the air. First, I loaded up the memories with various convenient messages. Message one was simply "CQ." Message two was "DE" and message three was "KF4PV." This may appear a bit fragmented to the casual observer, but there is method to this madness. The MK-800 lets you string your messages together. For example, by pushing the sequence 1-1-1-2-3-3-3 I could send "CQ CQ CQ DE KF4PV KF4PV KF4PV" and tack on a "K" manually. By manually sending my contact's callsign and pushing the sequence 2-3, I could reply "VR6TC DE KF4PV." (Note—supplied callsign is purely wishful thinking.) The MK-800 allows you to string up to 99 messages together.

After the rest of the memories were loaded with the usual stuff about rigs and weather, it was time to tune up. Putting the Swan into the CW/Tune mode, I pushed the MK-800's tune button. The rigs keyed and meters were dipped. Pushing the tune button a second time unkeyed the rig. Just in case you are forgetful, the tune function turns itself off after ten to fifteen seconds. My unit timed out after thirteen.

I hunted around for a clear frequency, and finally finding one, pushed 1-1-1-2-3-3-3. After a couple of repetitions, a Pennsylvania station answered and we had a pleasant QSO. I was able to keep up a smooth flow, mixing manual and memory keying. My contact, when asked for a critical signal report, said that there was no click and that the signal was easy to read. This indicated that the lack of weighting was no problem and that the relay keying circuit did not change the keying waveform.

The MK-800 makes CW a lot more fun. It's slightly strange to watch your rig sending the obligatory rig and weather discussion in perfect code while you're sitting back with coffee and a magazine. Just don't forget to take over when it finishes.

It was time to get ready for the DX contest. Besides the usual things one needs to plan, I now had to work out my message strategy. Among other things, I decided that one memory needed to contain the word "test." When I tried to enter it, though, I suddenly began having troubles. The machine would load "eist" or "eht" or other nonsense, but not "test."

The MK-800's one-year parts and labor warranty states that the unit should be mailed back to Triangle Electronics Laboratories in case of trouble, but since the contest was coming up soon and Durham is relatively close by, I decided to get in touch with the folks directly first. I described my problems, and the next day was given a new EPROM to substitute for the one in the unit. Once it was installed, the problem with "test" went away completely.

It seems that I had found a problem in the Morse receiving algorithm used in the keyer. "Why should a keyer have a Morse receiver?" was my reaction. To read the straight key, was the answer. The MK-800 performs a running statistical analysis on the straight-key input. It keeps track of the lengths of time that the key is held down and the length of time between key-down periods. Based on the observed times and statistical summing of the past times, it decides whether a dit or dah has been entered. This way it can track a relatively sloppy fist, adjust to changing speeds, and tell when to insert a space if autospace is selected. (As a test, I hooked another keyer to the input of the MK-800 and sent varying speeds of code to the MK-800. The speed was increased from three to fifty words per minute in four seconds. The MK-800 tracked perfectly.) This does cause one limitation, namely that after power-up or reset, the first word received by the unit must contain both dits and dahs.

My problem was caused by a bug in the receiving program. Even though I was using the paddle inputs, these are eventually routed through the receiving program. The problem only occurred when the first word after reset did not contain a character with dits and dahs. It lasted only for the first word. Subsequent words were received correctly. However, the problem was found and fixed in less than a day by the unit's designer, and all units now use the new, correct software. Even allowing for the fact that I did not have to deal with the US Mail, this still ranked as the fastest warranty work I'd ever seen.

Finally, contest day was here. I had put up a new vertical for twenty meters and quick tests showed that it was loading and working well. I hooked up the MK-800, loaded the message buffer (with no problems this time), and fired up the rig. Calling CQ was effortless, and responding to stations calling CQ was also very easy. I had a 3×5 card that showed the order in which to push the memory butttons for CQs or replies. Things were going well as far as keying was concerned, but I wasn't having much success against the megawatters and their thousand-element beams up ten miles. So I cranked up the power from two hundred Watts in to four hundred Watts in. That's when the trouble started.

The keyer's relay suddenly began locking up. Every time I keyed the rig, it stayed until I manually switched back to receive mode. Putting the transceiver back to lower power fixed the problem. Back at high power, the relay locked up again. On a hunch, I disconnected the MK-800 and hooked up my old keyer. Sure enough, the old keyer is aluminum. Somehow, at high power, rf was leaking into the MK-800.

Next, I hooked up a straight key to the Swan. When I touched it, it was hot. Connecting the MK-800 again, I switched back to my longwire antenna. The MK-800 now did not lock up. I went outside and checked out the new vertical and found that there was a poor ground connection. This was causing loose rf in the shack and the plastic keyer case let it through. However, since then I have been unable to make the MK-800 lock up when it was keying a rig connected to a properly grounded antenna.

So the MK-800 keyer functioned very well in a contest, as well as in casual QSOs. I also used it to help train a class of Boy Scouts in Morse code. Here, the really useful feature was the battery backup for the messages. I could load the memories at home with long strings of straight and random text, unplug the unit, and carry it to the Novice class. Nearly six hundred characters at five words per minute will keep a class busy long past the point where they're actually learning anything, so I never ran out of material for the Scouts. In fact, I was able to use the same messages three weeks in a row without having to reload them.

In conclusion, the MK-800 is a very good keyer, with more features than any other keyer that I've seen in its price class ($150). The AEA keyer in the same price class has no memories or power supply. The next higher up AEA unit has ten memories, still no power supply, and costs $50 more than the MK-800. The MK-800 has six memories, automatic serial number, continuous-output speed control, paddle or straight-key input, and input editing functions. The straight-key input speed is com-

WHAT DO *YOU* THINK?

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pletely independent of the output speed and can vary over a very wide range. It has battery backup for the memories and can operate from +12 V dc or 110 V ac. It is a joy to use and looks good in the shack. The only disadvantages are the somewhat confusing manual and the lack of an earphone jack for the sidetone speaker, but they can be lived with. I recommend the MK-800 to anyone who wants a good, high-performance digital keyer at a good price.

For more information, contact *Triangle Electronics Laboratories, 7016 Windover Drive, Durham NC 27712; (919)-471-6738.*

Laszlo Morocz KF4PV
Chapel Hill NC



The IC-27A.

ICOM IC-27A

It all began several months ago when I realized that the summer just wouldn't be complete without a two-meter transceiver in the car. You know how it is: vacation plans that include a lot of driving, scenic tours with visitors from abroad, trips to the beach, short hops into Boston, and the usual daily trips to and from work, the grocery, etc. Obviously, I'd planned to spend a lot of time in the car and wanted a radio that would keep me in touch with my friends via the local repeaters, or even direct/simplex. New England is full of repeaters, and in spite of the rugged terrain you aren't ever out of "sight" of at least one repeater—usually several.

What to buy? The choices are staggering, with at least five or six major manufacturers trying to produce the best and most desirable radio at the lowest possible price. I wanted a full-feature mobile unit with about 25 Watts output, small in size, lightweight, neat in appearance, as well as versatile and convenient. Finally, I decided to opt for the ICOM IC-27A, mainly because of its diminutive tuck-away-anywhere size and its reputation with hams who spend a lot of time on the air from their cars.

The radio comes in two packages: an accessory box and the foam-encased transceiver. The accessory box contains a microphone, a power cord, a short length of coax with connector, and an assortment of plugs and connectors. The power cord is fused. The foam-protected transceiver is packaged with its mobile mounting bracket already in place.

The handsome dark-gray and chrome IC-27A measures a scant 1½"×5½"×7" and weighs a mere 42 ounces. You will like the mounting bracket which allows you to disconnect the transceiver by merely rotating two levers on the sides of the inverted-U-shaped mount.

General Features

The push-to-talk mobile microphone is furnished with a sixteen-button touchtone™ pad for repeater access of autopatch dialing. Just in case your favorite repeater has Private Line™ access, the IC-27A is ready with 32 on-board PL tones, selectable by the main tuning knob and storable in memory. Speaking of memories, there are 9 of them backed up by a seven-year lithium battery. Each memory is capable of storing the receive frequency, the transmit offset, the offset direction, and the PL tone of your choice. There is a scanning feature which you can set to scan either memory channels or vfo channels. There is also a priority-scan function, a convenient arrangement whereby you can select a particular channel and cause the radio to receive that channel whenever a signal appears on it, regardless of where else the radio may be "listening" or scanning. The IC-27A has dual-vfo capability, selectable by front-panel push-button, allowing you to set certain frequencies with vfo A and other frequencies with vfo B. To switch from one to the other merely requires the button to be pushed, a welcome and helpful convenience, especially in an emergency situation.

Transmitter and Receiver Features

The transmitter has two output power levels: 5 Watts and 25 Watts. Under modulation, the deviation is ±5 kHz from center frequency. Spurious emission is more than 60 dB below the carrier level, and the audio quality provided by the 600-Ohm electret condenser microphone is very good indeed. Simplex or duplex operation is selectable, and any offset within the band is programmable in 100-kHz steps.

The frequency coverage of 144 to 148 MHz is provided by a microcomputer-based, 5-kHz/step, digital PLL synthesizer. Frequency stability is within ±1.5 kHz between temperature limits of 14 and 140 degrees Fahrenheit and voltage limits of 11.75 and 15.85 volts dc. Power requirements while transmitting are nominally 13.8 V dc (negative ground) at 6 Amps maximum. Receiving current draw is 0.4 A squelched and 0.6 A with squelch open.

The receiver is a double-conversion superheterodyne using a first intermediate frequency of 10.695 MHz and a second intermediate frequency of 455 kHz. Sensitivity is given two ways: less than 0.2 microvolts for 12-dB Sinad, or less than 0.4 microvolts for 20-dB quieting. The squelch sensitivity is less then 0.15 microvolts. What all of this means to you is that it is a mighty sensitive little critter that can let you hear what you need to hear when you want to hear it. The spurious-response rejection ratio is more than 60 dB, and the receiver selectivity is more than 15 kHz at −6 dB, and more than 30 kHz at −60 dB. This means a filter shape factor of about 2:1, which allows excellent rejection of normally-deviated adjacent-channel signals. You can expect audio output power of up to 2 Watts—enough for normal quiet-car listening.

Scanning

As mentioned earlier, the memory-scan function allows you to monitor nine different preselected channels. The programmed-scan function permits scanning between two programmed frequencies, and full-range scan allows the entire band to be scanned. You can change the scanning speed, and the auto-stop function terminates scanning either when a signal is received or when a channel is free. Priority scan may be operator-selected to stop at a memory channel or a vfo channel, and by using sampling techniques, you can easily check to see if a particular frequency (channel) is occupied or free.

One available option of the IC-27A is a speech synthesizer to verbally announce the receive frequency by simply pushing a button. This permits you to know where you are at any time without the need to take your eyes off the road.

Using Your IC-27A

Here is where you will need to read the manual—several times if you're anything like me. There are so many features and functions that you can't "intuit" the thing and expect to get full performance from it. Like all modern rigs, it requires a learning process to furnish you with its entire capability, so we might just as will start with a short how-to paragraph or two.

The Vfo/Memory switch changes the rig from a memory channel to vfo and back again with a simple push. When you are in the memory-channel mode, a small M appears in the display, and the memory-channel number also appears. Note, however, that even in the vfo mode the memory-channel number still apears. The Vfo switch selects either vfo A or vfo B for tuning. In the out position, vfo A is selected and the vfo A indicator is illuminated in the display. When depressed, the switch selects vfo B, and the vfo indicator goes off. Personally, I would rather have the display show vfo B under these circumstances, but this is a minor point, since if no display is there, you know you're on vfo B.

In vfo operation, the front-knob tuning allows you to step the frequency up in 5-kHz (Tuning Rate switch in) and 15-kHz increments (Tuning Rate switch out). If you tune past the upper band limit of 146 MHz, the frequency automatically reverts to the lower limit of 144 MHz, and vice versa.

If you want to go from, say, 146 MHz to 147 MHz in a quick jump, all you have to do is press the 1 MHz Up button and you're there. To return to the 146-MHz frequency, just keep on depressing the button and the rig will cycle through 147 and 148, back to 144 and 145, and finally to 146 MHz.

The Memory Write/Offset Check button has dual functions. In the simplex mode (when neither DUP− nor DUP+ is displayed) pushing this button writes the displayed vfo frequency into the displayed memory channel. Note that each memory channel stores the operating frequency, the offset frequency, the offset direction, and the subaudible tone frequency, if any. When you are in the duplex mode, pressing this button displays the offset transmit frequency and allows you to listen to the repeater input (while you hold the button down).

The Offset Write button, when held down, causes the offset frequency to be displayed. This can be changed by pressing either the −Duplex, the +Duplex, or the 1 MHz Up button. Each push of the −Duplex button decreases the offset frequency by 100 kHz and each push of the +Duplex button increases it by 100 kHz. Pushing the 1 MHz Up button increases the offset by 1 MHz.

The +Duplex and −Duplex buttons set the offset frequencies in the respective directions by 600 kHz automatically, unless the Offset Write button is also pushed as mentioned before.

The Priority switch turns the priority frequency on or off. Here's a very nice feature: Let's say you are in QSO on a vfo channel, but want to see what's going on, if anything, on a priority channel. Or you're waiting for a friend to call. Just set that channel into memory and push the Priority button. The rig will check that priority channel every five seconds—automatically—for just a moment, enough to allow you to hear your friend when he (or she) calls. Conversely, if you are communicating on a memory channel, this switch will allow you to momentarily look at a vfo (previously set) frequency.

The Rf Power switch sets your transmitter to 25-Watt output in the out position, and to 5-Watt output in the in position.

The Tone Select button, when held in, displays the subaudible tone number on the frequency display panel and causes the Tone indicator to illuminate. While holding this switch on, you can rotate the main tuning knob and select the desired tone frequency.

The frequency display is four large 7-segment display digits representing the digits between 10 MHz and 10 kHz (46.91 representing 146.91 MHz, for example). The small 50, when illuminated, represents the final 5 kHz of the frequency.

The S/Rf indicator indicates S units in receive, and rf-power output in transmit. Note that this is a *relative* indication only and does not measure output power in Watts.

In the receive mode, when the squelch is opened by an incoming signal, a small green LED lights up.

The Tone indicator lights when any tone number other than 00 is set into the rig.

Rear-Panel Controls and Features

You will notice immediately that both the power connector and the antenna connector are at the ends of flexible cables rather than fixed to the rear panel. I asked Evelyn Garrison about this when I saw her at ICOM Day—Rivendell. She told me that the reason for this arrangement is so that the rear of the rig can be mounted nearly flush with a wall or a panel. Neat idea. If you happen to use an external speaker, you can plug it into the panel jack provided.

Underneath the access cover there are several switches and buttons. The CPU Reset switch resets the central processing unit of the microprocessor into its original condition. . .when the power is on. The Scan Speed switch sets the scanning speed to fast or slow, while the Scan-Stop Interval switch sets the interval to either about 9 seconds (long) or 3 seconds (short). The Vfo-Scan Mode switch can be set to PS (programmed scan) or FS (full scan) modes. A really neat feature is the Scan-Stop Function switch which allows the scan to stop on a busy channel or an empty channel.

When your unit is first turned on, the display will read "47.00" (representing 147 MHz) and the memory display will read "0" (representing memory channel 0). In the upper-left corner of the front panel, the M/Vfo switch can be pushed to display the M if you want to select a memory channel. You'll probably want to use the vfo at first, so *don't* push the switch.

Next, rotate the main tuning control to set the desired frequency into the display, using the desired tuning rate of either 5-kHz or 15-kHz steps, selected with the Tuning Rate control switch.

If you'd like to set up another frequency in the other vfo, just push the Vfo switch (marked A/B), also located in the upper-left corner and dial in the new frequency on

that vfo. Now you can have either frequency displayed (or in use) by merely pushing the A/B switch alternately. However, before you transmit, you should check to see which offset frequency is set up in the duplex mode, and whether it is plus or minus the displayed frequency. If neither DUP – nor DUP + is displayed, push the desired button so that your desired offset is displayed. For 146-MHz operation, the offset will usually be DUP – (transmit frequency *below* the receive frequency). Next, push the M W button at the lower-left panel location to see whether the proper (normal) 600 kHz is displayed. If so, you will be in business for most repeaters. If it is not the desired 600 kHz, then you will have to set the desired offset into the unit. To do this, press the Offset Write button in the lower-left portion of the panel, and, while holding it in, push the DUP – button until "0.60" (600 kHz) appears. In the same manner, other offsets can be selected. Finally, check your transmit frequency by pressing the M W button to display it. Let's say you have set up 146.25/146.85 as your channel pair. The display should show DUP – and 46.85. Then, pressing the M W button should show 46.25, which is correct. Now, pressing the mike button (you have plugged in your antenna, I hope) should allow you to access the repeater.

Simplex operation is achieved by merely depressing either DUP – or DUP +, until the display shows no offset. Your transmit frequency will then be the displayed frequency.

On The Air

One of the things you'll want to know is, "How do I sound on the air?" This is where the IC-27A comes into its own. Audio quality reports have always stressed a very clean and easy-to-understand signal, with penty of talk power. . .but no reports of over-deviation. In other words, you'll get through clearly if they can hear you at all. Sometimes, when the going gets "scratchy" and there is a drop out of your signal to the repeater, you may have to "say again, please," but you really didn't expect miracles, did you?

On the receive side, I personally like the recovered audio. For all practical purposes it is quite adequate, even plentiful, *except* in a noisy car with a lot of wind noise, traffic noise, or general conversation going on among your children or friends. However, none of the current rigs I know can solve this problem with their tiny, built-in speakers. There is one solution, of course, and it's the one I prefer—an earphone and microphone headset, one of the featherweight varieties of the type used by pilots or astronauts. ICOM just happens to have one of these little gems, and it exactly fills the bill for mobile use.

So, what can we conclude from all of this? I would like to say that the main premise has been realized: a go-anywhere, reliable, full-featured, and compact 2-meter radio that has built an enviable reputation for itself by virtue of its performance.

A good friend, who has used his IC-27A for the last year or so, swears by this rig as being the best he has ever used. It's a constant companion in his car—as it is in mine.

Suggested retail price for the IC-27A is $369.00. For more information, contact *ICOM America, Inc., 2380-116th Ave. NE, Bellevue WA 98004.*

Jim Gray W1XU
***73* Staff**

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I am a disabled ham on a limited income and am looking for parts for a Heathkit SB-300 receiver and an SB-401 transmitter, or a comparable pair for under $200. Can anyone help me get back on the air?

Fred Erickson
25 Forest Street
Millers Falls MA 01349
(413)-659-3121

I need the instruction manual and tuning information for a Telrex 2m beam, the one with a 14-foot boom. I especially need information about feeding the antenna and about making and installing the coaxial balun. I will pay for copying and postage.

Harris Ruben N2ERN
74 Apple Tree Row
Berkeley Heights NJ 07922

I need a copy of the ORD DK-1 Keyer manual. I will pay for copying and postage.

Bill Unger VE3EFC
Route 11
Thunder Bay, Ontario
Canada P7B 5E2

I'm looking for copies of these military manuals: NAVSHIPS 0967-173-7010 Volume 1, NAVSHIPS 92175, NAVSHIPS 93210, and MIL-R-12887.

Charles T. Huth WB8NLM
229 Melmore Street
Tiffin OH 44883

I need a station monitor that is compatible with the Heath HW-101. Heath made one, but I can't remember its nomenclature. I will pay UPS charges to Hawaii.

Fred Smallwood WA4JVL
COMTHIRDFLT
Pearl Harbor HI 96860

I am a new ham and need help in locating 6-, 2-, and 1¼-meter converters for a National NC-300 receiver.

Frank L. Hicks KA7VUG
683 East Hillside Oaks
North Salt Lake UT 84054

I would like information on how to add the optional low tones to an IRL FSK-500 RTTY TU. Also, I need a copy of the manual and schematic for this unit. I will pay for copying and postage.

Gary Kohtala WA7NTF
8419 158th St. Ct. East
Puyallup WA 98373

I need a service manual for a Galaxy V Mark II showing the circuit-board layout and parts placement. I will copy and return your original.

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RG8U 96% shield, mil spec.	$29.95/100 ft. or 31¢/ft.
RG6A/U double shield, 75-ohm	25¢/ft.
RG58AU stranded mil spec	12¢/ft.
RG58 mil spec. 96% shield	11¢/ft

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RG8X 95% shield	$14.95/100 ft. or 17¢/ft.
RG59/U 70% copper braid	9¢/ft.
RG8U 80% shield	18¢/ft.
RG58U 80% shield	07¢/ft.
RG58U 95% shield	10¢/ft.
RG59U 100% foil shield, TV type	10¢/ft.
RG8U 97% shield 11 ga. (equiv. Belden 8214)	31¢/ft.
Heavy Duty Rotor Cable 2-16 ga, 6-18 ga	36¢/ft.
Rotor Cable 8-con 2-18 ga, 6-22 ga	19¢/ft.

RG8U-20 ft., PL-259 ea. end	$4.95
RG214U dbl silver shield, 50 ohm	$1.55/ft.

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NEW PRODUCTS

ARCSOFT PUBLISHES SATELLITE HANDBOOK

The *1986 Space Satellite Handbook* from ARCsoft Publishers details 5,612 payloads, platforms, rockets, and pieces of debris in orbit around the Earth, moon, and sun.

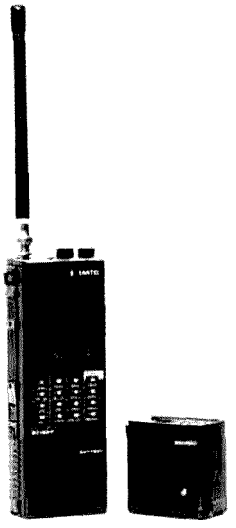
Data from NASA, NORAD, and the Smithsonian Observatory are included in this paperback book. Objects are listed with their international number, popular name, launch date, and country of origin. Orbital parameters including period, inclination, apogee, perigee, and NASA radio frequency are shown for each entry.

Complete details about the *Handbook* are available from *ARCsoft Publishers, PO Box 132AM, Woodsboro MD 21798.*

SANTEC ST-20T

Encomm, Inc., has announced a new addition to the Santec line of hand-held radios. The ST-20T covers 142–150.995 MHz with an output power of 5 Watts. Two seven-digit autodial memories allow automatic dialing through a repeater's autopatch. A 16-key keyboard provides access to 32 functions.

For complete information about the ST-20T, contact *Encomm, Inc., 1506 Capital Avenue, Plano TX 75074.*



The Santec ST-20T, available from Encomm, Inc.

ONE-TUBE RADIO KIT

A new one-tube radio kit is available from Antique Electronic Supply. The kit comes complete with all of the parts necessary to make a working radio, including a tube and a mounting board. Batteries and headphones are optional. The kit provides the radio experimenter or antique-radio buff the opportunity to learn early electronic construction techniques.

A 20-page catalog of tubes, parts, and books (including information about the kit), is available from *Antique Electronic Supply, 688 West First Street, Tempe AZ 85281; (602)-894-9503.*

TEC-200 IMAGE FILM

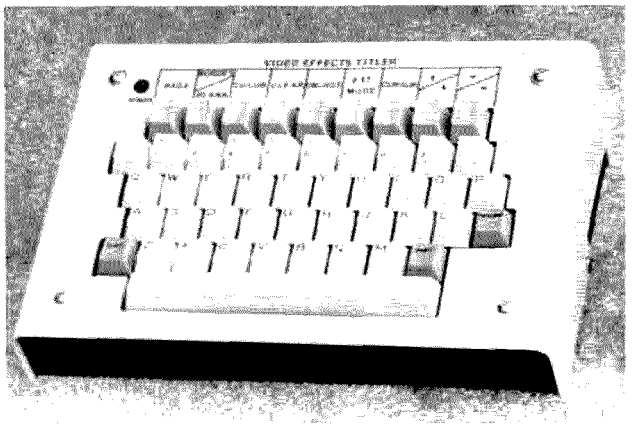
TEC-200™ image film, produced in West Germany and sold in the US by the Meadowlake Corporation, is part of a new system for creating printed-circuit etching patterns. TEC-200 film is placed in a standard photocopy machine. A PCB pattern from a magazine or book is transferred to the TEC-200, and then the pattern is transferred to a copper board by using a hot iron. After the film is removed, the board may be etched with any common etching agent. The resist is then removed with a standard solvent.

For detailed information about TEC-200 image film, contact *Meadowlake Corporation, 25 Blanchard Drive, Northport NY 11768; (516)-757-3385.*

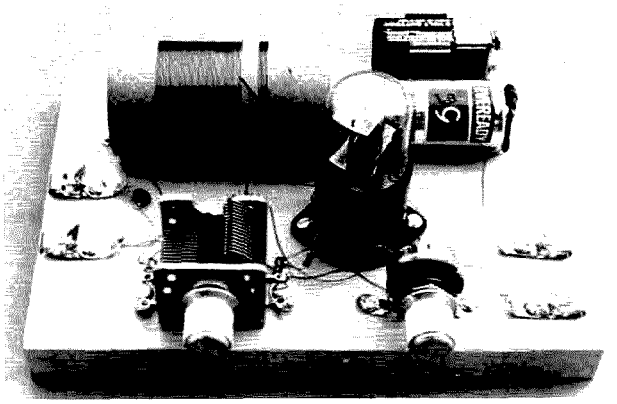
MFJ VIDEO TITLER

MFJ Enterprises has announced their Video Effects Titler (VET), a computer-based stand-alone titler for professional and home-video use.

The VET allows the superimposition of 30 pages of color titles over a camera image, or titles may be added over existing video footage during editing. Each page holds eight lines of sixteen upper- and lowercase letters. Each character may be one of 15 colors. Title pages are retained in memory when the VET is turned off or unplugged.



MFJ's Video Effects Titler.



A one-tube receiver from Antique Electronic Supply.

For more details, contact *MFJ Enterprises, Inc., 921 Louisville Road, Starkville MS 39759; (800)-647-1800.*

DAVLE TECH CRIMPING KIT

Davle Tech, Inc., has introduced the CTK-8 crimping kit. The kit includes a crimping tool and an assortment of insulated terminations. The crimping tool will handle insulated or uninsulated terminals, will cut small bolts and wires up to 10 AWG, and will strip the insulation from wires between 10 and 22 AWG.

For complete information, contact *Davle Tech, Inc., 2-05 Banta Place, Fair Lawn NJ 07410; (201)-796-1720.*

EVERETT/CHARLES SUPER MODEM 1200

The Super Modem 1200, available from Everett/Charles Marketing, is a 300/1200-baud modem designed for use with RS-232C-compatible computers and terminals. It is functionally equivalent to the Hayes modem, and uses both Bell 103 and 212A standard tones. Other features include autodial, redial, touchtone™ or pulse dialing, and full- or half-duplex operation.

For complete details, contact *Everett/Charles Marketing Services, Inc., 6101 Cherry Avenue, Fontana CA 92335; (800)-443-1860.*

DSE SATELLITE RECEIVER KIT

The Australis I satellite receiver kit is now available from Dick Smith Electronics. The kit has been designed to make construction and alignment as simple as possible—only a standard multimeter and a signal source are required. The front and rear panels are silk-screened, and the circuit board is solder-masked fiberglass with a screened component overlay.

For more information about the Australis I, contact *Dick Smith Electronics, PO Box 8021, Redwood City CA 94063.*

CES BEAMCALC SOFTWARE TOOLBOX

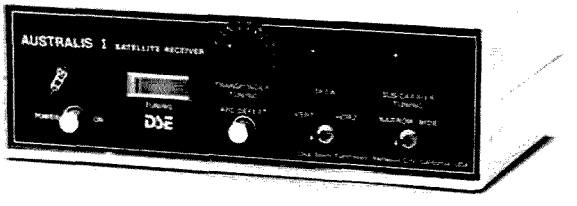
Communications Electronics Specialists, Inc., has announced the CES BeamCalc Software Toolbox for the Commodore 64 and Apple II computers. The software calculates beam headings from the operator's location to any location in the world. Also displayed are the latitude and longitude of the selected location, the distance in statute and nautical miles, the time difference from UTC, the DX zone number, postal rates, the number of IRCs required for a postal reply, and QSL bureau information.

Other programs in the Toolbox handle line-of-sight calculations, satellite tracking, moon tracking, and solar-phenomena predictions.

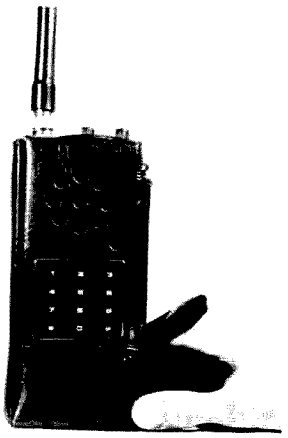
For more information, call or write *CES, Inc., 803C South Orlando Avenue, Winter Park FL 32789; (800)-327-9956.*

CTCSS ENCODER ADDS DIP-SWITCH PROGRAMMING

Selectone Corporation has redesigned their model ST-130 Digitone CTCSS encoder to include a six-position DIP switch for tone programming. The new model provides 37 CTCSS frequencies between 67 Hz and 250.3 Hz. The unit operates on 5.5 V dc and draws less than 2 mA. The output level is adjustable to a maximum of 1 V rms. The ST-130 is compatible with all standard CTCSS systems, including Private Line™ and Channel Guard™.



The Australis I satellite receiver from DSE.



Crowley Manufacturing's Delta-Zulu HT case.

For more information, please contact *Selectone Corporation, 28301 Industrial Blvd., Suite L, Hayward CA 94545.*

DELTA-ZULU IC-2AT CASE

Crowley Manufacturing has introduced the Delta-Zulu soft-vinyl case designed to fit the IC-2AT/3AT/4AT series of hand-held radios. A clear plastic window gives access to the keypad, and a zippered battery door allows the user to change the battery pack without removing the case. There are openings on the top and back of the case for controls and plugs. The Delta-Zulu case is available in either black or burgundy and can be used with or without a belt clip.

For more information, contact *Crowley Manufacturing Company, 95 Federal Street, Lynn MA 01905.*

MICROWAVE MODULES 2M GaAsFET MULTIMODE

Microwave Modules of Liverpool, England, has announced the MMT144/28R solid-state multimode transverter. The MMT144/28R can be used with any 28-30-MHz transceiver having a low-level (.25-300-mW) power output.

The receive section includes a noise-matched NEC GaAsFET preamplifier and a high-level double-balanced mixer, providing excellent strong-signal-handling characteristics and immunity to cross modulation.

The transmit converter provides an output of 25 Watts and incorporates an alc circuit to ensure a clean signal. A visual indication of relative power output is given by an LED bar-graph display.



Microwave Modules' MMT144/28R 2m transverter.

Dc power requirements are 13.8 V dc at 6 Amps. The alc range is 20 dB. The receiver's noise figure is 2 dB or better with a third-order intercept point of 19 dBm.

For more information, please contact *The PX Shack, 52 Stonewyck Drive, Belle Mead NJ 08502; (201)-874-6013.*

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Happy New Year, one and all! I do hope that this year will bring each and every one of you everything that your hearts desire! For many of you, that wish has been a program to put your personal computer onto RTTY, and I hope that this column has helped more than a few of you fulfill that wish.

Now with that said and with a bit of a lump in my throat, let me quickly apologize to those of you whom I am about to upset. By means of an allusion last month, I hinted that a particularly delicious computer would be the subject of this month's software review. Unfortunately, I am still waiting for at least one response to an inquiry I sent out. So, rather than just spin my wheels, let me tell those of you who have managed to appropriate or acquire a big blue box (IBM PC or compatible) what's in the RTTY cards for you.

A couple of years ago, when an owner of an IBM-style computer wrote me for RTTY information, all I had to say was "tough luck," but now, with the proliferation of these machines in the hands of hams, all this has changed.

A rather typical looking station is an IBM PC with 128K of RAM, serial communications card, RS-232-to-TTL drivers based on a 1489-1488 chip pair, and all this feeding a Flesher TU-170 interfaced to the ham rig.

Software in use at this station is a program advertised by Bob Johnson AA4L, 11305 Rums Hill, Raleigh NC 27614, which is apparently available for a formatted disk and a few dollars. It is rumored to be available as well on several bulletin boards, usually called "TTY22."

The program provides 60-, 75-, and 100-wpm Murray (Baudot) transmission, several disk messages, and can key the transmitter via RS-232 signals and the 1489-1488 pair. The display is not split-screen; receive and transmit data are interspaced. However, there is a buffer to type ahead for transmit while receiving.

One of the hams using this program tells me that he has added a storage slot for the callsign of the current station being worked, function keys to switch speeds, disk recording of callsigns after a QSO with duplicate checking, disk message interrupt, and "several other things." In addition, he eliminated some of the "cumbersome" features, like a start-up logo, speed-select menu, and such. Just shows you what can be done with some of the user-supplied software traded and modified on "the boards."

Another of you tells me that his IBM PC interfaces to his rig through a CP-1 and uses the Hamcom program, version 3A, from Emile F. Alline, Jr. NE5S, of Metairie LA. I am told that this program encompasses Murray, ASCII, and CW, as well as code practice. Saving data to disk, printing out to the printer, and storage of "canned" messages are also supported. Sounds like another interesting program, although I have no idea as to the cost.

Another program in use is by Glenn Welman KF4NB, 3301 Pastern Ct., Lexington KY 40513, and is distributed as "freeware." In the literature, which I have seen an abstract of, the author says to share the program with others who are interested in RTTY, but not to sell or barter the program. When the program is passed along, only the unmodified version, along with the guidelines, should be included. A self-addressed stamped envelope to the author will get you the latest update, and any and all contributions will be accepted.

The program requires an IBM PC or compatible, with at least one drive and 128K of RAM, an asynchronous communications adapter, and DOS version 1.1 or better. It would appear that the program will function on a PCjr with some limitations.

Display is in either monochrome or color, with 80 x 25 and 40 x 25 character modes available. The split-screen has receive data on top, and transmit on bottom, and run-time information (including current date and time and elapsed time since the last ID) is in the center of the screen. Meanwhile, the bottom of the screen contains error codes, information messages, and function-key information.

It even maintains the old CR-CR-LF-LTRS end-of-line sequence required by manual teleprinters!

Baud rates equivalent to Murray 60, 67, 75, and 100 words per minute are supported, as well as ASCII baud rates of 100, 110, 300, 1200, and more! There's even a 4K buffer for you to fill from the keyboard while receiving.

All this in a program that apparently is available for the asking, for which the author only asks you to send him what you think it's worth. Sounds good!

Now, as to the hardware itself, a few of you have found it less than perfect for amateur use. One of you tells me that rf in the shack gets the PC excited. That was cured by grounding the keyboard, monitor, and CPU cabinet to a six-foot ground rod driven into the basement floor. Another of you must be having similar problems, in that there is so much rf in the shack, that RTTY output must be limited to ten Watts or so, or else. . .

My thanks this month to Bo Barry W4GHV of Las Cruces NM, Elliot Hamilton WA9JIQ of Arlington Heights IL, Anson R. Hyde, M.D. K4EK of Virginia Beach VA, and our old friend from the 68xx camp, Clay Abrams K6AEP, of San Jose CA, for their many contributions regarding their experiences with the PC.

Other machines have not been so lucky, however, and I still am at a loss for our friends running the Osborne 1. Is anyone out there running an Osborne 1 on RTTY? This column has several devoted—but frustrated—readers who would love to put their attaches on RTTY but lack the software. Any knowledgeable folks out there? Let me know. Thanks.

Ditto on the Timex/Sinclair. It seems that a lot of folks picked one of these little computers up for a song or got one as a premium with this or that electronic (or nonelectronic) purchase and now look wistfully at the keyboard and display and wonder. Well, so do I. I have received questions, but few answers. If anyone is running one of these wonders on RTTY, drop me a line, OK?

Okay, folks, listen up—now I've got a problem. A few months ago, I mentioned that Bill Davidson KW4J is using a partic-



The RTTY corner of C. A. Waterhouse W4INM's shack.

ular RTTY program on his TI-99/4A. I need to contact you, Bill, and can't find your address anywhere. So, if Bill is reading this month's column, or someone is reading it who knows Bill and can get this to his attention, I would appreciate a little note in the mail or via CompuServe. Thanks.

Received a note from Robert Holland, M.D., Ph.D. K7PCJ who is having some trouble finding the XR-2206 function generator used in the simple AFSK generator detailed here a few months back. Well, when I wrote that column the chip was hanging prominently on the wall at my local Radio Shack. Unfortunately, it has been dropped from their latest catalog. It is still quite available, however, from a variety of sources. James Electronics includes it in their blister-packed wall display available from a number of local outlets, as does Digi-Key and a number of other parts suppliers. Look around at some of your local electronics stores and you may be surprised.

Ron Vickery, one of our readers from Ellenboro NC, writes a few, as he puts it, "basic questions." He has acquired an old Allied R-100 general-coverage receiver and wonders if he can use it on RTTY. Ah, Allied Radio—that sure brings back memories. Back in my Novice days we used to pick our parts from thick newsprint catalogs produced by Allied, Lafayette, and several others. Now, but a memory. Oh well, back to the question. Ron says that the receiver has a beat-frequency oscillator (bfo) and implies that it receives sideband as well. But, he keeps seeing where the ads push digital dials and such for mucho buckolas.

Ron, if the receiver receives sideband it should work fine on RTTY. Receiving the two modes requires much the same technique, and drift that would render a RTTY signal unreceivable would render a sideband signal unintelligible. What you will need is any of the "interface" boxes that we used to call terminal units, or TUs, also known as demodulators. This box takes the audio, tapped from the earphone jack or speaker, and converts it into the on-off or plus-minus voltages of a TTY loop or RS-232 computer interface.

You said that you have a CoCo (TRS-80 Color Computer), and that will be a fine computer to get onto RTTY with. We will be covering some of the available software in the very near future right here, so stay tuned.

On the air with AMTOR, Larry Hawes KA4QZQ of Venice FL is looking for the best filtering between the receiver and his AMTOR unit. Well, Larry, I guess the key word is "active." Those little op amps and chips have pretty much replaced the boards of donuts that we used to have in the days of 88-mH toroidal coils. I have seen a number of active-filtering schemes, and I don't have any current information as to which is the "best," and why. Will try to print what I can, though, as your cohorts let me know what they are using. (Hint, hint.)

Getting kids into amateur radio has always seemed like a good thing to do, and David Peterson in Osseo, Wisconsin, is doing just that by incorporating amateur radio into his high-school communications class at Osseo-Fairchild High School. I do wish you the best of luck, and hope that the material I sent you at your request will be a help.

While it isn't exactly RTTY, I have never been bound by that before, so let me tackle a question sent in by Guy Roussel, M.D., of Lincoln, Maine. Guy is interested in the WEFAX program, a program designed to decode weather and other facsimile transmissions and display them on the screen of a CoCo. Specifically, he would like to find a version of the program for the Commodore 64 computer. Well, sorry, Guy, but when I put that question to Marty Goodman, M.D., one of the sources of the program, he told me that the program just cannot be adapted to the C-64. Problems include the less powerful CPU in the C-64, as well as other restrictions in hardware. With hardware prices falling, why not bite the bullet and switch over? I think you will be surprised at the power of the 6809 CPU, which can even run a sophisticated system like the UNIX-like OS-9 and still be friendly enough to play games.

Well, I asked about a "shack of the month" photo, and here is the first one. This is the RTTY corner of C. A. Waterhouse W4INM. He has a number of Teletype® Model 32 and 33 machines and agrees with me that there is no such thing as a "standard" call control unit. It looks like quite a setup; one only wonders what the XYL says when all the machines are chattering away! Thanks for the photo, and I took forward to receiving others.

As always, I enjoy all your comments and questions, which have been coming in both via mail and CompuServe. I'm trying to keep up with the responses, and I think the stack on my desk is smaller than ever. Of course, electronic mail is normally answered on the same day, so send it to 75036,2501 on CompuServe, and I'll see what I can do. Yes, the reprint list is still available for a self-addressed, stamped envelope. It grows every now and then, so if you think you might be missing something, I won't be upset if you ask for another. Just drop me a line, with an SASE to the above address.

More next month on a variety of topics. With the spectrum ranging from grease-bangers to computers to WEFAX, I guess you never know what might turn up in "RTTY Loop."

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

Before I go on with this month's column, let me say that while I do consider myself a bit more proficient on VHF/UHF than the average ham, being an "expert" of sorts doesn't protect one from our dear friend Mr. Murphy when he decides to play havoc with a station. Let's now consider a case in point: The use (and misuse) of mast-mounted preamplifiers.

Why use a mast-mounted preamp at all? (Why, indeed, I've been asking myself, as you'll soon see!) There are a few reasons, but the primary reason is to provide sufficient preamplification of weak signals to overcome transmission-line losses.

Let's assume you are trying to work weak signals on 432 MHz. Assume for the moment that your receiver front end has a noise figure of 3 dB. Assume also that you are using a run of 8214 Belden coax and have feedline losses of 3 dB. If you want to hear a signal in the noise or at the threshold of your receiver noise, you've got to make up at least 9 dB of gain someplace! This would overcome the 3 dB loss of your feedline and also the additional noise generated by such a preamp, leaving you with about 3-5 dB of additional signal to work with, placing that same signal at about S½ copy. Still not a great signal, however.

The problem is that you can't use the preamp at the receiver input, for you've already added 3 dB of loss in your feedline to the already weak signal, putting it 6 dB below the threshold at which you can detect it (3 dB below the noise figure, which is also 3 dB)!

The answer is to put the preamp at the antenna, or tower head. Only here can the full benefits of a preamp be realized in such a situation, for the signal is already 3 dB stronger when it arrives just by overcoming feedline loss. Assume you feel that a signal must be at least S1 for you to be able to copy it clearly. Then your preamp must be able to supply at least 12 dB of gain: 3 dB to overcome your receiver's noise figure, 3 dB to overcome the feedline loss, and 6 dB to raise the signal from noise threshold to about S1 copy.

This presupposes that your preamp generates no noise—which is not the case. It, too, will generate a certain amount of noise, and this noise will have to be added to the overall calculations. Now let's get a bit more up-to-date and revise those figures to take into account the latest developments in receiver front-end design, transmission lines, and preamplifiers.

Now your 432-MHz receiver has a noise figure of 2 dB, using the latest in microwave bipolar transistors. And you've spent a few bucks on a GaAsFET preamp with a claimed noise figure of 1 dB. You've already made up 3 dB of difference right there over the previous setup. And you also decide to change to Belden 9913 coaxial cable, which gives you only 1.5 dB of loss.

Now you have to overcome a total of 4.5 dB instead of 6-8 dB using the previous setup (and that assumes the previous setup used a preamp with noise figure of 2 dB). If your preamp has a claimed gain figure of 15 dB, that means that the net gain at the receiver front-end stage (after overcoming front-end noise) is 10.5 dB, which is almost a two-S-unit increase! Now the signal that was in the noise is clearly readable. Quite a difference from before!

Of course, you can make additional improvements by going to lower-loss transmission lines and bigger antenna arrays. The problem is that there will always be *another* signal "just in the noise" to confound and frustrate you. Ah, the problems of the UHF afficionado . . .

To get back to the story, I decided that a mast-mounted preamp was just the ticket. Murphy was standing behind me at the ticket window, looking over my shoulder. Was I in for it!

By way of setting the scene, I use a Kenwood TS-430S at 28 MHz as my i-f for a 432-MHz microwave module. The noise figure of said module is about 1.7 dB. I also use an array of four F9FT 21-element yagis on an H-frame to yield about 20 dB or so over an isotropic dipole.

The transverter and antennas are connected by about 70 feet of Prodelin 1/2" Spiroline cable, which has about 1.5 dB of loss per 100' run. My loss then calculates to about 1 dB, meaning that I would have to overcome about 2.7 dB of noise and loss to compensate. If I wanted to bring a signal that was "in the noise" up to about S1, I would need a total of 9 dB of gain.

Another 6 dB would raise it to S2, so the total gain of the preamp would have to be about 16 dB (assuming -1 dB for the noise generated by the preamplifier). The Advanced Receiver Research 432 VDG seemed like just the thing, as it claimed 16 dB of gain with a .5 dB noise figure.

Initially, I tried two Dow-Key relays to put the preamp in the line on receive and take it out on transmit. The relays were SPDT types, and a footswitch in the shack operated them along with the transverter standby switch and amplifier bias control. When 26 volts was sent up the tower, the relays energized and the preamp was bypassed. This worked fine for about one day before Murphy got to it. Apparently, a spike got into the GaAsFET and blew it to pieces, for I hadn't sufficiently protected against spikes by using bypass capacitors and diodes across the relay coils. SCORE: Murphy 1, KT2B 0.

No problem. I connected a 1N4004 rectifier and bypass capacitor across each relay contact and, after repairing the blown device, re-installed the preamp on the tower. So far, so good. This particular lashup lasted almost a week before Murphy discovered the rf-sensed keying line in my MMT 432/28S transverter. While demonstrating the station to a friend, the microphone gain was inadvertently set too high, and the TS-430 keyed, driving the transverter sufficiently so that the Mirage D1010N amplifier I was using fired a bolt of about 50 Watts up the feedline to the input of the preamp. Kaboom! SCORE: Murphy 2, KT2B 0.

Long hours of research and thought

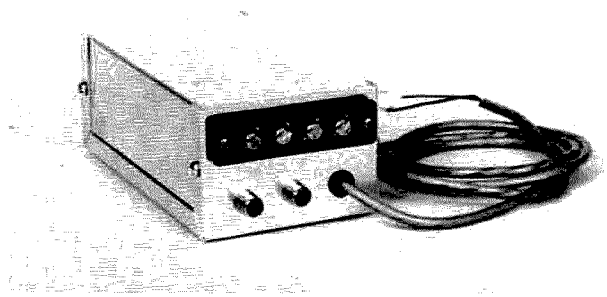


Photo A. The ARR sequencer. The two RCA jacks bring in the PTT line and key the bias for the amplifier. Additional closures are available through the terminal strip.

brought this revelation: Why not energize the relays on receive and have them drop-out on transmit! This would provide additional protection against lightning strikes and mysterious voltage transients floating about when the station was off the air. Additionally, should the preamp fail while in use, I had but to cut off the operating voltage and it would be permanently bypassed by the coax relays. A stroke of genius!

In addition, I would employ a system of cascading relays to ensure that everything was keyed in the proper sequence—preamp out, relays switched, amplifier bias set, and finally, transverter in standby. (Needless to say, I disconnected the rf-sensing feature to avoid problems in that area!)

A chassis was fabricated for the sequencer. Four relays were scrounged from the junk box, and a power supply and switching circuit were devised. Each relay was a DPST type, which allowed me to use the second set of contacts to key the next relay in line. In theory, it should provide enough delay for everything to key up in order and prevent another rf blast into the preamp. When the transmit line was released, the relays would release in sequence, or so I hoped.

It just didn't work out that way, however, when Murphy got through with it. After several weeks of serious 432 DXing, he payed another visit to the shack and somehow got the sequence all jumbled up. Sure, they all keyed in the right order, but dropped out in the wrong order, and eventually one relay got caught in the wrong position. SCORE: Murphy 3, KT2B 0.

Shortly after this, I happened to be at the Dayton Hamvention and came across Jay Rusgrove W1VD at Advanced Receiver Research. I suspect it was because of me that he had just introduced a new product: a mast-mounted amplifier sequencer, using linear circuits to achieve a consistent ramping effect so that all devices connected to it would key-up and drop-out at the same time, every time.

At $49.95 it seemed reasonable. (I had already spent almost that in GaAsFET repairs!) I purchased his last unit. The unit was installed in a box with all connections brought out to one end for easy access (see photo A). The unit employs four relays as it comes from ARR: one SPST normally-closed relay, and three SPST normally-open relays.

The first relay supplies the voltage to the preamp and antenna relay, while the next three key-up and set bias, set PTT lines, or put transverters into standby. The unit employs a 555 timer to ensure a solid closure no matter how short the PTT interval is. This in turn drives an LM3900 which functions as an integrator to provide a linear up and down ramp effect to drive the two dual comparators, types LM319.

Each has a threshold-voltage level on its input and each changes state on the up and down ramps according to that trigger voltage, keying the appropriate relay. The entire sequence takes about 30 milliseconds, which is enough to ensure that everything is settled before rf is applied.

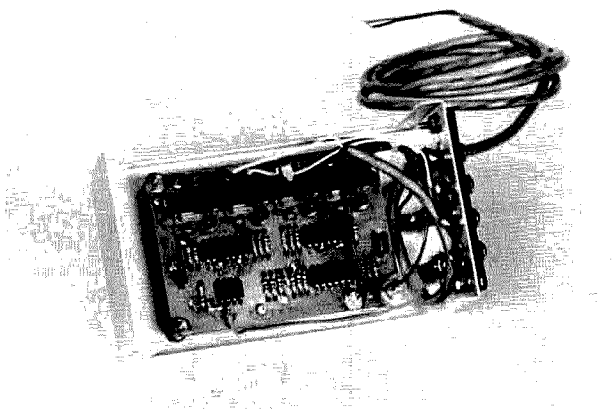


Photo B. The sequencer with cover removed. Two SPST NO-type relays are installed, upper left on the circuit board.

Although Jay recommends that the preamp and antenna relay be keyed at the same time through the first relay, which is the SPST NC type, I couldn't do this (because of problems with different supply voltages) until I used a voltage-dropping scheme at the tower head. The 432 VDG preamp uses a 5-volt regulator and 28 volts would have been too much to handle, so I dropped the voltage with a zener and resistor to about 15 volts. Unfortunately, I forgot to consult with Murphy after consulting with Jay, and he apparently got miffed. After about three weeks of moderately reliable operation, the zener either failed or the resistor opened. SCORE: Murphy 4, KT2B 0.

I called Jay again and advised him of the problem. After a short discussion (no, he didn't offer me stock in the company) I ordered a second SPST NC relay. My idea was first to remove the voltage from the preamp (13.8 V dc) and then release the voltage from the relays (26 V dc). The unit was modified accordingly, and Photo B shows a close-up of the sequencer with the new relay installed.

The Magnecraft type W171DIP relays on the upper-left portion of the board are both SPST NC types, and the W107DIP relays to the right are both SPST NO. The order of firing is left to right on transmit and right to left on receive. The power cord goes to a companion power supply which provides 13.8 and 26 volts for both the transverters and the mast-mounted preamp combination.

Believe it or not, this setup made it all the way through the September VHF Contest. I was able to work my weak signals—including WB4SLM from Grid EM85 in western North Carolina, over 500 miles away. Finally, I could reap the benefits of a mast-mounted GaAsFET without fear of accidentally blowing up the preamp.

Murphy was stumped! Had I actually thwarted him at last? Not exactly, as it turned out. Murphy had one more card to play.

You guessed it. I blew up the sequencer. Apparently, while I was testing a few 4CX250 power tubes at 432 MHz for output, one bad tube either shorted out or went into oscillation. Something got into the grid bias line, and the relay which keyed the operating bias of −135 volts shorted internally, arcing through the LM319 comparator and taking the LM3900 integrator with it. As an added bonus and at no additional charge for his services, Murphy made sure that the preamplifier got a blast from the tube. SCORE: Murphy 5½, KT2B 0. (The 1/2 point was for the sequencer!)

Which brings us to the present. A recent trade brought in about 50' of ⅞" Andrew heliax cable, and another trade brought the two N connectors required. It can handle lots of power, doesn't generate any noise, and will give me another 1 dB of gain just by its lower loss rating. Best of all, I don't have to sequence it. Murphy is fuming now and has packed his bags to head out to parts unknown.

Let me add that I haven't given up on the idea of a mast-mounted preamplifier, however. A second ARR sequencer is in the line keying the transverter and amplifier bias, so I can confirm that the previous problem is not likely to happen again before I install my sixth preamp on the tower. Besides, think of the weak signals I could work with a 16-dB preamp and ⅞" hardline from a 20-dB array at 50 feet...

From the mailbag this month comes a letter by way of the Philippines. Jose Antonio B. Conde of Cebu City writes to tell of the increased activity on 144-MHz FM. Most operators, he says, use the ICOM 27A and small yagis. Other operators employ Kenwood TR-7950 rigs, and with all the conversation and QRM it makes for a lively situation on 144 MHz.

He also suspects that there are a few bootleggers around (no surprise here, we've got plenty on 2-meter FM, Tony!) but most QRM is not really intentional; it's just the product of too many stations on a small band.

Tony also inquires as to what could be purchased in the $500–$600 range in US dollars to outfit a good VHF-multimode station.

Well, in this country, Tony, you could put together an ICOM 271 multimode and KLM or Cushcraft beam for about $600 and change. Or you could use an ICOM 290H and Mirage amplifier together with that same beam for about $675.00. Of course, there are lots of used pieces of equipment around. By far the cheapest way to get on 2m SSB is to use a 144-MHz transverter with a low-band radio; such a transverter, amplifier, and antenna in US dollars would run about $425, giving you 100 Watts to a good-sized yagi. Hope this answers your question.

Frank White W8OY from Mentor, Ohio, writes in to inquire where he can locate RG-17 or RG-18 coaxial cable. For those readers who are unfamiliar with this type, it's a 50-Ohm, ¾"-diameter, armor-jacketed transmission line that was quite popular with the armed services. It resembles garden hose, and the braid on the outside is quite strong and difficult to break through.

Frank, I don't know of any direct sources but here are some addresses you might try to locate this cable, or an acceptable substitute:

Madison Electronics Supply 3621 Fannin Street Houston TX 77004 (1-800-231-3057)	Nemal Electronics 12240 NE 14th Ave. Miami FL 33161 (1-305-893-3924)
Certified Communications 4138 South Ferris Fremont MI 49412 (1-616-924-4561)	Texas Towers 1108 Summit Ave. Suite 4 Plano TX 75074 (1-800-272-3467)

Frankly, for the cost of such cable you might be better advised to use either ½" hardline or Belden 9913 RG-8/U coax. Either is more plentiful and both can handle up to a kW on 144 MHz with minimal loss.

Addendum

The reading public can be quite unmerciful at times, but in this case it is justified. Yours truly made a few bonehead statements in the October, 1985, "Above and Beyond" column regarding stacking of beams for extra gain in VHF and UHF operation.

Perhaps the biggest mistake was to try and condense a complex topic into a few paragraphs. I'll try to address a few mistakes as quickly as I can: First of all, increasing the size of an array at VHF or UHF (or at *any* frequency, for that matter) *increases* rather than *decreases* the aperture of the array (much like using a lower F-stop number on a camera lense; as you "open up" the aperture, more light is transmitted). Secondly, the front-to-back ratio can remain the same or improve, depending on the construction of the array. Thirdly, in many cases optimal gain achieved in stacked arrays actually can increase the side-lobe pattern, not decrease it. Side lobes *can* be decreased by changing the spacing between different elements of the array, but at the cost of gain. Also, the pattern of the antenna will change with the above adjustments. About the only thing I will say with certainty is that stacking beams does offer increased forward gain, and the gain figure as well as the radiation angle will vary depending on the distance between each element of the array (such as between four identical 432-MHz yagis).

As was stated in the October column, the recommended minimum spacing between yagis in such an array is at least half the boom length. For some of the newer long-boom high-gain yagis, this figure changes considerably. Again, the spacing between yagis will determine not only gain but radiation angle as well, often increasing apparent gain over long paths to more than 3 dB. Your best bet is to read more about it; there are several articles by Joe Reisert W1JR that deal with the subject more scientifically in the April and May, 1985, issues of *Ham Radio*. I'll try to present a more detailed and technically accurate treatment of this subject in a future column.

HAM HELP

I'm looking for a schematic and service information for a CR1/43044 transmitter/receiver manufactured by the Colonial Radio Corporation.

Mickey Knight N4LVN
144 Del Ray Court
King NC 27021

I am looking for an owner's manual or service information for a Hammarlund HQ-170 receiver. Please let me know how much it will cost.

Columbia Communications
PO Box 8117
Lowell MA 01853

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: International Editor.



CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol, Cyprus

Radio activity in Cyprus during the last few months was rather restricted, mainly due to propagation. But the regular dozen or so 5B4s were active mainly on 20m. Also during this summer, many foreign hams who came on holiday were working /5B4. These were mostly British, German, and other European amateurs. They usually operated on 2m with small HTs, but some operated also on HF from the shacks of 5B4 stations.

A very pleasant visit to my QTH was that by Frank DJ@QZ, who operated from my shack on HF. Also, I had another visit from a very good friend with whom I had lots of QSOs, OM Ezzat SU1ER, who also was visiting Cyprus as a tourist. Ezzat also met other 5B4s in Nicosia, who entertained him at their local radio club. We do hope that visiting amateurs in Cyprus will contact 5B4s when they arrive. We are sure that they will find the friendship and brotherhood that comes out of our hobby.

An activity organized by CARS for the first time ever was a national VHF contest. This took place in the 2nd week of August, and the winner will receive the CARS president's cup. We do hope to have more contests in the future.

Some interest is shown currently in RTTY and satellite operation. On RTTY, regular operators 5B4OP in Nicosia, and 5B4JE in Limassol with his harmonic, George 5B4OV. There also are a few other RTTY operators, but they are not very active. On satellite work we have Akis 5B4OA working OSCAR 10. Other OSCAR users are 5B4HF and 5B4KP (when he is in Cyprus). Trying to get ready for OSCAR are 5B4NG, 5B4RU, and 5B4CV. 5B4JE hopes to operate OSCAR 10 from the shack of 5B4CV, and during the winter will have a go at RS satellites. I would like to thank, through this column, Giannis SV1DO, who sent me a program for OSCAR and gave me all the recent Keplerian elements. It gave me a few moments of excitement and pleasure when I heard OSCAR for the first time.

Official permission was given to Cyprus amateurs for the use of special prefix 5B25 by any station wishing to do so—from the 16th of August until the end of last year—to commemorate the 25th anniversary of the independence of the Republic of Cyprus. It seemed to be a popular prefix because when 5B4s appeared on the bands using it, terrific pileups were created.

ZC4 activity at the moment comes mostly from the base of Dhekelia. Stations at the Episkopi base are not active at the moment. ZC4AP was heard coming from the Akrotiri base, and my very good friend Andy ZC4AM told me that as of October he will be active as ZC4AM/P from the salt lake of Akrotiri within the base area.

ZC4MR, 5B25JE (5B4JE), and 5B25MF (5B4MF) are checking regularly with the W7PHO Family Hour net with the very good company of Len KB2HK, net controller. Let's hope that propagation during the winter will improve, and we will be very happy to meet new stations on this net.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenského 1477/8
955 01 Topolcany
Czechoslovakia

The evaluation of the best Czech and Moravian radio amateurs takes place annually. One Friday in January, 1985, the best radio amateurs met in Tisnov to receive prizes for their many years of service. The placings were determined by a vote of the members of the Czechoslovak Central Council of radio amateurs. First place was won by a world champion in radio-orientation racing and a master of sports, Ing. Mojmir Sukenik, with 270 points. Pavel Sir OK1AIY received 183 points and second place for his work on UHF. Third place went to Ing. Karmasin OK2FD for his work on HF (166 points).

In the 1984 VK/ZL RTTY DX Contest, three Czech radio clubs acheived the top scores in the multi-multi category. They occupied the first 3 places in the world in this order: OK3KJF, OK3RJB, and OK3KXJ.

Besides that, OK2-21478 won first place in the world in the SWL category. OK1DRX improved his RTTY operation by means of a ZX-Spectrum computer, and by means of this computer made contact with OK1VAT in the 145-MHz band.

AMSAT-OSCAR 10

From the end of April till the beginning of October, 1984, Jenda OK2EH, operating CW, made 150 contacts with 56 DXCC countries. He has been using electronic equipment of a multiplier type with an REE3OB electron tube. The receiver is an MWEc with a converter. The antennas are a 12-element yagi for receiving and a 15-element yagi or a spiral antenna with 10 turns for transmission. All of them are adjustable in azimuth and elevation.

Radio club OK1KRA wrote that it had worked the following Czechoslovak stations: OK1AIY, OK1KHI/P, OK1DIG, OK1KTL/P, OK1DKS, OK1DTL, OK2AQK, OK3AU, and OK3RMW. OK1KRA is the first station from Czechoslovakia and the first from the socialist states that has worked 57 DXCC countries.

Some remarks made by an operator at OK1VPZ:

- It is necessary to listen closely. Our antennas are a 16-element F9FT yagi and a 2 x 9-element F9FT yagi crossed for a circular polarization with a preamplifier.
- For these antennas, is necessary to have an exact prediction of the position of the satellite. It would be best to use a computer.

In one and a half years, Ondrej OK3AU has made, in mode B, about 2500 contacts with 67 countries. He has worked under other callsigns as well: OK5MIR, OK5KWA, and OK@WCY. Ondrej confirmed the sad reality that unnecessary overloading of the converter in mode B has not been changing for the better at all—on the contrary, the number of stations using enormous erp without improving their receiver system has increased.

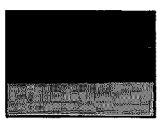
Vlasta OK2VPA from Opava has also been working through AO-10/B, where she has made 100 contacts. She is most proud of her contact with the VS6XLA in Hong Kong.

RS SATELLITES

At present, during the period of quiet sunspots, there are good conditions for working via the RS satellites. At the beginning of 1985, OK3AU, OK3FH, and OK3ZFA were working regularly on them. Also, stations from Bohemia and Moravia, OK1DJW, OK1BMW, and OK2AQK, appeared. From time to time, some unique stations with special prefixes (EU, EO, EW, EV), station UA@KAJ from Kamchatka, and the JW stations from Spicbergy can be heard.

Michal OK2BXF from Brno made contacts with 28 countries through the RS satellites. He made some contacts with an erp of 5 Watts through RS5. He heard himself with 15 mW of erp through the now-nonfunctioning RS6.

According to unofficial information, new satellites RS9 and RS10 have been successfully examined in Kaluga near Moscow. They ought to be launched into space at the end of 1985. The satellites will be equipped with two converters each: 145/29 MHz and 21/29 MHz.



FEDERAL REPUBLIC OF GERMANY

Ralf Beyer DJ3NW
Opferkamp 14
3300 Braunschweig
Federal Republic of Germany

TRAINING FOR SPACELAB

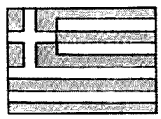
On Saturday, August 17, 1985, a Cessna 207 aircraft took off from Cologne at 1105 hours local time with astronauts Ernst Messerschmid DG2KM and Reinhard Furrer DD6CF aboard, in preparation for their radio-amateur activity during Spacelab mission D1. The flight was oraganized by the German Aerospace Research Establishment (DFVLR) in cooperation with the MBB-ERNO company and the University of Bremen. The purpose of this flight was to test the 70-cm/2m transceiver that the astronauts would use aboard Spacelab and to get the astronauts familiar with the pileup to be expected during their space flight.

The flight took about 4 hours and 50 minutes and covered a large part of Germany. A route of 1100 kilometers was flown at an altitude of up to 11,000 feet. Practically everybody in Germany had a chance to get in contact with the aircraft, and even radio amateurs from Austria, Belgium, The Netherlands, and France were calling.

The astronauts used the call DF@LRK/air-mobile. This was the first radio-amateur activity from an aircraft to be authorized by the German FCC.

As usual, few radio amateurs were able to contact the astronauts directly. Many calls were taped, and it is hoped that the analysis of the 3-hour recordings will reveal about 300-400 callers. All stations identified will receive a QSL.

Messerschmid's comment, "They are calling faster than I can think!" showed that the astronauts really got a live demonstration of what may be expected during their space flight.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

The RAAG has a new address: Eleftherias Square 23-24, 105 53 Athens, Greece. Also there are two phone numbers: 3234527 and 3234624. Anyone who would like to be informed about reciprocal licensing, etc., is invited to write or phone.

Keep in mind that band allocations are not the same everywhere and information obtained from RAAG officials will prove to be very useful—especially when somebody wants to operate on the 2-meter band.

The annual meeting of IFATCA (air traffic controllers) was held last year in Athens from March 16-22. From the Royal Olympic Hotel (where the meeting took place), J4ATC was activated while the meeting was on, by W1BFA and PR@GJA. Although there was something missing in the call (should have been J41ATC), the station attracted a lot of DXers worldwide. I would like also to mention that Spyros Stefanou SV1IR was responsible for organizing this meeting; he did an excellent job.

A couple months ago, I was telling you about SV1JG, who took part in the *CQ* Worldwide WPX SSB contest. Today I feel proud to say that Greece, for the very first time in its radio history, has a continental winner in the single-operator allband category. Cliff, with his special call, J41JG, scored 1,667,576 and took first place in Europe. We hope next time Cliff will reach an even better position.

A new repeater will be active very soon from Enos Mountain on the Island of Kefalonia. The new repeater operates on repeater channel 2 (145.650/.050) and it is hoped that along with R8 it will cover all the Ionian sea area and the nearby mainland.

By the way, we are about to use up the string of two-letter callsign endings. If I am not mistaken, SV1ZZ has been issued already; we all expect to hear SV1ZZZ very soon.

MT. ATHOS

I would like to discuss a situation which has given a lot of trouble to many SV DXers, including myself, and some RAAG officials, too. As most of you know, Greece supports four DXCC countries—Mainland (SV), Dodecanese (SV5), Crete Island (SV9), and Mt. Athos (SV/A). To really understand the story, you need to know that since Mt. Athos is a rare place

not only to operate from but even to visit, there is always big demand for a QSO with this DXCC country.

In order to go there, you need a proper license from the Greek PTT which is conditional and requires a written permission from the Holy Community to be valid. Because of a very complex situation, it is very difficult to get permission to operate from there (a signature is needed from every leader from the 20 monasteries). The last organized and valid operation was back in 1980, by SV1DC, SV1IW, and SV1JG.

Since then a lot of Greek and foreign amateurs have tried to get permission but with no luck. To be truthful, it looks like somebody told the Holy Community of Mt. Athos that the only purpose of expeditions is for green stamps and IRCs! Personally, I believe that this is the reason for no permits since then.

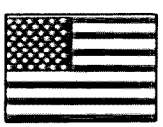
Despite this, in 1984, DJ5CQ went there without a written permit from the monks and operated for a while. In 1985, DL7FT did the same thing. He claimed that nobody had had a written permit for the last 10 years.

This was going too far. I sent the German league a letter of protest and a copy of the original license which I obtained in 1980 from the monks, along with translations in German and English.

A little after this, another presumptive DXer followed for another two-day show. (Remember him as KF1O/CE0X?) That was another suitor for Penelope's hand. (You will understand if you know Greek ancient history.)

The conclusion, after all these attempts, was to force the RAAG to write a letter to the Greek Ministry of Telecommunications and ask it not to issue a license for Mt. Athos anymore unless the applicant has a written permit from the monks in hand! Apart from that, I sent informative letters along with copies of my license and translations in English and German to all major DX Bulletins and magazines in an effort to prevent people from wasting their time and money.

Mt. Athos is a fine place to visit and a *real* fine spot to operate from. Will we ever be allowed back?



GUAM

Edward L. Campbell KB6DAW/KH2
300a Rendova
APO San Francisco 96334

HAFA ADAI FROM GUAM

Since propagation is poor and it looks like it is not going to get any better for a while, I thought it appropriate to bring up nets again—this time because there have been some good check-ins on them. And again, I will give times and frequencies that they are on.

To start off, I am a regular check-in for the 220 net with P29JS as net control. Lately, he has been on holiday and is back on Norfolk Island. His call now is VK9NS, but he will be returning soon. In his absence, VI2HD and I have been sharing the duties as net control.

Here are some of the check-ins that you will find on the net: VK9NL, FW8AF, 9M2MM, FT8XB, 3B8CA, YJ8RG, and 9V1TL, to name a few.

We have been blessed to have most of the DXpeditions check in with us, such as HC8E, 6Y5NR/KP1, and XF4—just to name a few. So if you hear of an expedition, you might look for it on the net.

Also, those that have propagation at 1100Z can look on 14.195 for RF@FWW every Wednesday, for his net. 5X5GK has tried to check in the last couple of weeks. Also 9N1RNK has been known to check in.

I have had a chat with XU1SS, and they are beginning to be up on the air a little more. You will find them around 1100Z at about 14.195. They do a lot of CW, so you might get a CW contact.

Have been trying to check in with the PHO net, but it is hard to get in with most of the antennas pointed into Europe. Now this is at 2100Z. I have had some luck turning my antenna over Europe and getting in that way. Now TZ6FE has been checking into the net quite often. So if you need that one, look for him at 2100Z. Maybe some day I will get to work him. So you might look into this part of the world from time to time—you might be surprised!

I did put out that I was trying to go to Johnston Island for a DXpedition, but it was turned down. I went on a DXpedition to KH9 Wake Island from October 22 until November 4. The calls were as follows:

- KB6DAW/KH9 for SSB contacts
- KA6DAW/NH9 for the *CQ* WW Contest only
- NY6M/AH9 for CW contacts

NY6M is now on KH2, and his name is Gary Dein. And he is a good CW man.

All QSLs should go to the address above.

Well, more next time. 73 and hafa adai from Guam Island, where America's day begins!



HONG KONG

P. J. Weaver VS6CT
10A Bonaventure House
91 Leighton Road
Hong Kong

Sunday, June 2nd, dawned bright and clear with a 15-knot wind from the east. A Cessna 172 was airborne from Kaitak at 0830 to reconnoiter the course to a rock called Pedro Blanco, 50 miles to the east of Hong Kong. Hong Kong's first offshore power-boat race from a position south of Aberdeen out to Pedro Blanco Rock and return, a distance of 120 miles, was scheduled to start at noon.

There were ten power boats entered for the race, the largest being a Cigarette 27′ and the smallest a Fletcher 21′ with two 120-hp outboards. For safety purposes, mark boats were to be established every ten miles of the course. These boats were a real mixture: from the largest, a Techma 68′, down to a Bertram 38′. All were well-found boats, and on each would be a radio amateur to handle communications, ship to ship and ship to aircraft, operating on channel 10, 156.5 MHz; all the hams were to keep in touch through the repeater on 145.650 MHz.

At 0900, the first mark boat started eastward, and by 1030 hours, it reported seas of up to 6 feet at times. When the aircraft had made its run the tide and wind had been running together, but with the turn of the tide at 0900, the wind against the fast ebb produced a short steep sea which the mark boats found difficult to cope with. By 1100, it was apparent that the mark boats were not able to get to their assigned positions.

The committee put on their thinking caps, and at 1130, having recalled the mark boats through ham radio, changed the course to run inside Hong Kong waters: It would be three times around a triangle from Lamma Island, just south of Aberdeen, to the Soko Islands, and thence to Potoi Island to make up to the original 120 miles.

It was still very bumpy going upwind, and Ramesh Murjani, the organizer, in his Cigarette 27′ was the only finisher on a circuit shortened to two laps (80 miles).

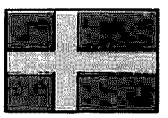
Our thanks to Hong Kong hams VS6IC, VS6XPQ, VS6DK, VS6XPZ, VS6XPT, VS6DM, VS6GW, VS6CT, and Macau ham XX9WW, without whose assistance even the abbreviated race could not have been held.

In my last report I mentioned that Hong Kong was following the United Kingdom with a class B license for 30 MHz and above. At this time there are over 150 class B licensees.

A new club has been formed within the Hong Kong Telephone Company's Sports and Social Association due to the enthusiasm of one ham, Marvin Chan King Tung VS6XNR, to whom full credit must go, as without his drive and interest the club could never have started. They now have over 350 members, all employees of the Telephone Company, keen to pass the necessary examination and get their licenses. They will shortly establish a club station and be very active with their assigned callsign of VS6TS; they also have their own club repeater on two meters.

With the increase in local hams there is a need for more repeaters, and the current two could well be expanded to four by the end of this year.

Just a brief reminder if you intend to visit Hong Kong and would like to operate. A visitor's license is readily available, so bring a copy of your home license with you next time you visit. The callsign assigned is your home call /VS6. Call me at home on 5-772313, or Ed Nance VS6DX on 5-231358, for full details and information about what's happening in Hong Kong when you get here.



SWEDEN

Rune Wande SM@COP
Frejavagen 10
S-155 00 Nykvarn
Sweden

WORLDWIDE QTH LOCATOR

The origin for the QTH-locator (grid) system used by the European VHF/UHF enthusiasts was in the 1950s. For many VHFers, chasing QTH locators (such as IT50d, giving fairly good accuracy on the position of the QTH) has become an obsession comparable with the most avid HF-band chasers of new DXCC countries.

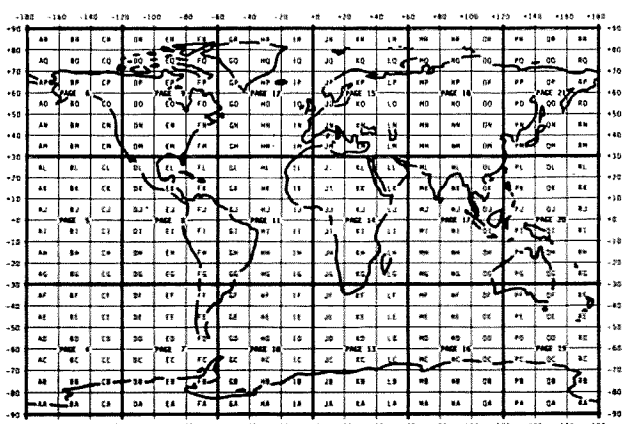
The original QTH-locator system had its drawbacks. It was designed for Europe, and if extended to cover worldwide, the system had to repeat itself, i.e., the same QTH-locator designation could mean quite different locations.

The increasing interest in using the QTH locators, not only as needed during VHF contests, but also because of the increased coverage of the world's surface that VHF/UHF operators have achieved, made it obvious in the mid 70s that a worldwide system should be designed.

Maidenhead Locator System

The European VHF managers held a meeting in Maidenhead, United Kingdom, in April, 1980, where Folke Rosvall SM5AGM presented the more than 20 proposals for a new locator system which had been received. The VHF managers found that the system proposed by G4ANB with the modification by SM5AGM should be put forward to IARU for adoption.

Folke SM5AGM started the work on an international scale for a worldwide locator system by presenting his ideas at the VHF-manager meeting held in Amsterdam, Netherlands, in 1976. In October of



World map of the fields.



Folke Rosvall SM5AGM.

AMATEUR TELEVISION

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- **FULL COLOR, SOUND, & LIVE ACTION** just like broadcast TV. Get on this exciting amateur video mode at our affordable ready to go price.
- **WHAT IS REQUIRED FOR A COMPLETE OPERATING SYSTEM?** The TC70-1s downconverter outputs to any TV on ch 3 for receiving. Connect a good 70 cm antenna and low loss coax. Plug in any composite video source you want to transmit: Camera, VCR, computer, etc. Plug in any low Z dynamic mic or use color camera mic for Standard 4.5 mHz TV sound. Connect to 13.8 vdc for base, mobile, or portable. See chapt. 20 1985 ARRL Handbook. That's it!
- **WHAT CAN YOU DO WITH THE TC70-1 ATV TRANCEIVER?** Show the shack, projects, computer program listings, home video tapes, repeat Space Shuttle audio and video if you have a TVRO, repeat SSTV or RTTY, Weather Radar, do public service events such as parades, marathons, races, CAP searches and rescues . . . the list goes on. DX depends on antennas and terrain, typically 1 to 40 miles. We have video compensated RF linear amps for 20 ($119) or 50 ($189) watts pep for greater DX.
- **FEATURES:** Small 7x7x2.5". Push to Look (PTL) T/R switching. GaAsfet downconverter tunes whole 420-450 mHz band. Two switch selected video & audio inputs . . . RCA phone jacks and 10 pin color camera jack. Xmit video monitor output. Over 1 watt pep RF output on one or two (add $15) selected crystal controlled frequencies. 439.25, 434.0, or 426.25 mHz.

CALL OR WRITE FOR OUR CATALOG for more info or who is on in your area. We stock antennas, modules, and everything you need on ATV.

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P.C. ELECTRONICS
Tom W6ORG Maryann WB6YSS

2522 Paxson Lane
Arcadia CA 91006

from page 4

have to agree with them. After all, Chet's *Computer Trader Magazine* stands to increase its circulation due to the heightened (and free) publicity, and the equipment manufacturers also get to look good by donating prizes. In the end, the contest is just a way of using ham radio to increase sales.

An Answer?

You might have noticed that I applied a general rule of thumb in each of the four instances to decide whether it constituted commercialism or not. You can call this Donham's Law if you like: *If the action could eventually result in money exchanging hands, it is a definite no-no.* The solution to the problem of commercialism in our hobby is to place in the amateur rules this strict definition of business communications.

The new rule would not differentiate between commercial ventures and nonprofit organizations (note that TAPR is nonprofit). The sole criterion would be the exchange of funds. No exceptions. With such a definition in place, much of the junk that we hear on the bands would disappear—then maybe these bells would stop ringing in my head.

Perry Donham

HAM HELP

I am looking for automobile and motorcycle amateur-radio callsign license plates for my collection. I will pay postage. I also have a few plates to trade.

W. C. Spenn KD5AK
Box 33081
San Antonio TX 78265

I'm looking for a computer interface for a Commodore-64 like the MFJ-1226 or the MFJ-1228. Also, I need a manual for a Heathkit HW-7.

Edward Turner
4376 W. Coolidge Rd.
Coleman MI 48618

1979 Folke proposed a system with 20° x 10° units, 2° x 1° smaller units, and 5' x 3' smallest units. Quite independently, G5ANB had designed a similar system.

The locator consists of two letters (the field) followed by two numbers, the square in the field, and two letters giving the position within the small square in the field. This system gives the position of the QTH with an accuracy of better than four kilometers (2.5 miles). On the HF bands and for the Field Award, it is enough to know the large unit, the field, i.e., the two first letters.

Folke has been the driving force for this worldwide locator system. Without his persistent work and refusal to let the opposition kill this effort, a worldwide locator system would probably still be far in the future.

The Field Award—
A New Challenge

Now it is time to start collecting fields for the new Field Award issued by SSA, the Swedish National Amateur Radio Organization. The Maidenhead Locator System has been adopted by all three IARU Regions and has worldwide coverage.

Altogether there are 324 fields, and you surely will not work all of them in a year or two, if ever. 262 fields are covered by some kind of land, 8 fields are covered by permanent ice without land, and 54 fields are covered by open sea. Stations operating /MM and polar expeditions will be needed for working all fields!

What is my Locator or Field?

The *World Atlas* containing all 32,400 Maidenhead locator squares, produced by SM5AGM, will readily give you most fields by knowing the QTH of the station you have worked. If you want to have your own full locator, the booklet includes a computer program for the necessary calculations. You must find out your longitude and latitude in degrees and minutes.

If you have any questions on either the Field Award or the *World Atlas*, write to The Field Award Manager, SSA, Ostmarksgatan 43, S-123 42 Farsta, Sweden. Please include an SASE or SAE plus IRCs.

Any questions about the locator system, including a request for finding out your own locator (do not forget to include your longitude and latitude) can be sent to Folke Rosvall SM5AGM, VasterskarsrIngen 50, S-184 00 Akersberga, Sweden. Please include an SASE or SAE plus an appropriate number of IRCs to cover his expenses. Folke compiles a "Worked Locator Field List" on a quarterly basis. Why don't you send your score per band to Folke to be included in the list!

Whenever working a station on any band, always exchange Maidenhead locators or at least the two letters for the field.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of January are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
January 1986

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2249	1	0000	206	12	189	17	162	16
2251	1	2300	196	16	178	18	152	13
2253	2	2300	189	16	172	16	147	9
2255	3	2200	179	17	161	15	138	4
2257	5	2100	168	17	151	11	130	0
2259	6	2000	157	14	142	7		
2261	7	2000	152	11	137	3		
2263	8	1900	143	7				
2265	9	1800	134	2				
2267	10	1800	130	0				
2272	13	0400					227	1
2274	14	0300					219	7
2276	15	0300					214	9
2278	16	0200					204	14
2280	17	0100			218	6	194	17
2282	18	0100	226	0	213	9	188	17
2284	19	0000	219	6	203	13	177	18
2286	20	0000	213	8	197	14	171	17
2288	20	2300	204	12	187	16	160	15
2290	21	2200	194	15	176	17	151	11
2292	22	2100	183	17	166	16	142	7
2294	23	2000	173	17	155	13	133	1
2296	24	2000	166	15	150	10		
2298	25	1900	156	13	141	5		
2300	26	1800	147	9	133	0		
2302	27	1800	142	5				
2304	28	1700	134	0				
2309	31	0300					230	0

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

WORLD SSB CHAMPIONSHIPS

Announcing the January Classics—the 1986 running of the World SSB Championships! The first and only contests of their kind, these five (5) individual single-band events are world-renowned and amongst the most challenging events on the bands today. Winners of each contest determine the World Champion for 15-, 20-, 40-, 75-, and 160-meter single sideband:

January 11, 1986
0000-2400 UTC
5th 40-Meter World SSB Championship

January 12, 1986
0000-2400 UTC
5th 75-Meter World SSB Championship

0000 UTC January 18, 1986,
through 2400 UTC January 19, 1986
7th 160-Meter World SSB Championship

January 25, 1986
0000-2400 UTC
2nd 15-Meter World SSB Championship

January 26, 1986
0000-2400 UTC
2nd 20-Meter World SSB Championship

Stations may be worked only *once per event*. All contacts must be two-way SSB. All stations, regardless of operating class, may operate the entire contest period.

OPERATOR CLASS:

(a) single operator, single transmitter, SSB only; (b) multi-operator, single transmitter, SSB only.

EXCHANGE:

Stations within the 48 continental US states and 13 Canadian provinces or territories transmit RS report and state, province, or territory. All others, including Alaska and Hawaii, transmit RS report and ARRL DXCC country.

QSO POINTS:

5 QSO points for contacts *within* your own *continent*.

10 QSO points for contacts *outside* your own *continent*.

MULTIPLIERS:

1 multiplier point is earned for each continental US state (48 max.), Canadian province or territory (13 max.), or ARRL DXCC country (excluding the United States and Canada).

SUGGESTED FREQUENCIES:

21.250-21.350; 14.175-14.250; 7.050-7.080 (DX); 7.175-7.250 (W/VE); 3.760-3.790; 3.805-3.875; 1.830-1.850; 1.855-1.900 MHz.

DX WINDOW:

For the purpose of this event, DX window frequencies are reserved for *split-band operation only*. W/VE stations are *not* to transmit in the window at all. DX stations *may* transmit but *must* receive outside the window frequencies. DX windows include 7.080-7.090, 3.790-3.805, 1.825-1.830, 1.850-1.855, and 1.907-1.913 MHz.

FINAL SCORE:

Total QSO points × multiplier points = claimed score.

ENTRIES:

Entries *must* include (1) a contest log, (2) a dupe sheet for 100 or more contacts, (3) a list of multipliers, and (4) a summary sheet as outlined below. Be sure to *include* your soapbox comments and a black and white *photo* for possible publication.

SUMMARY SHEET:

Summary sheets must contain (1) contest callsign, (2) your state, province, territory, or ARRL DXCC country, (3) station owner's name and mailing address, (4) a list of station equipment and antenna(s), (5) the operator class, (6) total QSOs, (7) total QSO points earned, (8) total US states worked, (9) Canadian provinces and territories worked, (10) the total of ARRL DXCC countries worked, (11) total multiplier points, and (12) your claimed contest score.

ENTRY DEADLINE:

Entries should be mailed to the appropriate contest chairman listed below. Entries must be *POSTMARKED NO LATER THAN FEBRUARY 20, 1986*. Late entries will be registered as check logs.

DISQUALIFICATION:

Contestants may be disqualified if they run illegal power, cause deliberate interference, fail to comply with the rules for the DX window, attempt to achieve a scoring advantage, or if duplicate contacts not cancelled exceed more than 3% of the total contacts made. Decisions of the contest committee are final. Disqualified stations will be barred from these events for one year thereafter.

PENALTIES:

A penalty of 100 QSO points will be assessed for each duplicate contact counted in a contestant's claimed score.

AWARDS:

A minimum of 100 QSOs must be worked in an event to be eligible for a contest award. Plaques will be issued to the World Championship Stations. Awards will be issued in each operator class, in each continental US state, Canadian province and territory, and ARRL DXCC country represented.

RULES AND FORMS:

Contestants are encouraged to use official contest forms. To obtain your own copy of the rules and each contest form, send an *SASE* to: *Contest Rules and Forms, Billy Maddox KA6JJK/3, 1162 Bayview Vista Drive, Annapolis MD 21401.*

Mail Your Entry To:
15-Meter Contest Chairman
Gary Vest WA3KCY
Star Route, Box 34
Holliday TX 76366

40-Meter Contest Chairman
Dennis Younker NE6I
43261 6th Street East
Lancaster CA 93535

160-Meter Contest Chairman
Harry Arsenault K1PLR/4
704 Curtiss Drive
Garner NC 27529

20-Meter Contest Chairman
Chuck Ingram WA6R
44720 N. 11th Street East
Lancaster CA 93535

75-Meter Contest Chairman
Ron Johnson KC7PA
68 South 300 West
Brigham City UT 84302

ARRL STRAIGHT KEY NIGHT
Starts: 0000 UTC January 1
Ends: 2400 UTC January 1

Sponsored by the ARRL, this is a friendly meeting on the air using straight keys. Suggested areas of operation on 80, 40, and 20 meters are 60 to 80 kHz from the lower band edges and 10 kHz from the lower Novice band edges. When participating, use "SKN" instead of RST preceding the three-digit report to clue in passersby. Following SKN, send a list of stations worked plus your vote for best fist heard during the period. Note, your vote does not have to be from the stations worked; it can be another station you've heard working SKN. This is not a contest, so quick contest-like exchanges are discouraged. Include a vote for the most interesting QSO besides your best-fist vote

RESULTS

1985 New Jersey QSO Party
Top-Scoring Stations

New Jersey		Out-Of-State	
WA2WJY	27,450	W5PWG	1,152
NC2V	25,920	K4FHQ	629
W2MYA	18,792	KY7M	592
K2AA	11,858	K4BAI	576
KA2VAZ	10,948	W@GAX	576
		N1PL	544

CALENDAR

Jan 1	ARRL Straight Key Night
Jan 5	ARRL Midnight Special
Jan 11	5th Annual 73 40-Meter World SSB Championship
Jan 11-12	Hunting Lions In The Air Contest
Jan 11-12	QRP CW Contest
Jan 11-12	ARRL VHF Sweepstakes
Jan 12	5th Annual 73 75-Meter World SSB Championship
Jan 18-19	7th Annual 73 160-Meter World SSB Championship
Jan 18-19	Antenna Experimenter's Contest Sprint
Jan 18-19	North Dakota QSO Party
Jan 25-Feb 2	ARRL Novice Roundup
Jan 25	2nd Annual 73 15-Meter World SSB Championship
Jan 25-26	Michigan YL QSO Party
Jan 26	2nd Annual 73 20-Meter World SSB Championship
Jan 26-27	Classic Radio Exchange
Feb 1-3	New Hampshire QSO Party
Feb 8-9	Dutch PACC Contest
Feb 8-9	YL-ISSB QSO Party—Phone
Feb 15-16	ARRL International DX Contest—CW
Feb 22	RTTY World Championship
Mar 1-2	ARRL International DX Contest—Phone
Mar 15-16	YL-ISSB QSO Party—CW
Apr 12-13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
Jun 7-8	ARRL VHF QSO Party
Jun 28-29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12-13	IARU Radiosport Championship

BADGER STATE
Smoke Signals
Serving Amateur Radio in Wisconsin

NEWSLETTER OF THE MONTH

Imagine our surprise when we opened the latest *Badger State Smoke Signals*—and a pair of 3-D glasses fell out! The glasses, donated by a local television station, allowed us to see the Yellow Thunder (Wisconsin) ARC's Field Day operation *as if we were actually there!* To our knowledge this is the first time that 3-D pictures have appeared in a radio club newsletter.

But the flashy pictures are not the only reason that *Smoke Signals* is this month's winner. We've been consistently impressed by the quality and breadth of the coverage given amateur radio by Editor Ken Ebneter K9ZZ. *Smoke Signals* is a publication that serves all of the radio clubs in Wisconsin, so Ken obviously has a great deal of information to draw from. Each issue we've seen has been lively reading, and we'd like to congratulate Ken and his crew for putting out such a great publication.

To enter your club's newsletter in 73's Newsletter of the Month Contest, send it to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

and mail a report to ARRL Headquarters, Newington CT 06111 by January 10, 1986.

ARRL MIDNIGHT SPECIAL
Starts: 0400 UTC January 5
Ends: 0600 UTC January 5

During the first hour use 80 CW; during the second hour use 75 phone. Work stations once on each mode. Suggested frequencies are 3540-3570 and 3855-3895. Exchange 3-digit consecutive serial number beginning with 001 plus name. Final score equals total number of QSOs worked with no multiplier. Mail entries by February 3, 1986, to ARRL Headquarters, Newington CT 06111. Top scores will be listed in *QST*.

HUNTING LIONS IN THE AIR CONTEST
Starts: 0000 UTC January 11
Ends: 1200 UTC January 12

The contest is sponsored by Lions Clubs International and coordinated by Lions Club Rio de Janeiro Arpoador—Brazil. Participation in the contest is open to all duly-licensed radio operators, Lion and non-Lion. There are two modes: phone and CW. Participation in both modes is allowed but points are counted separately. All amateur stations participating must operate within their licensing regulation. Separate categories will exist for single-operator and radio clubs/societies. Multi-operators may participate as long as they do not operate simultaneously with the same prefix. However, each callsign used must be listed on the log.

Use 80, 40, 20, 15, and 10 meters. Associates of the Lions Club of Rio de Janeiro Arpoador will operate mainly within the first 50 kHz of each band and around 14.270, 21.270, and 28.550. Only one QSO with the same station on each band and each mode may be counted. Remember that phone and CW are counted separately!

EXCHANGE:

RS(T) and sequential QSO number. When contacts are made with Lions, Leos, or Lionesses, the name of the club contacted should be clearly identified.

SCORING:

QSOs within the same continent count 1 point, while those between different continents count 3 points. Score 10 extra bonus points for each QSO with a member of a Lion, Lioness, or Leo Club from a different country or 5 points within the same country. Score 20 bonus points for a QSO with a member of the Lions Club Rio de Janeiro Arpoador or for each QSO with a member of the Melvin Jones Memorial Radio Club of the United States. Score 25 extra points if contact is made with the Arpoador official station with callsign PY1LCA.

Contacts between Brazilian stations and members of the Arpoador club, as well as North American stations and Melvin Jones Memorial Radio Club, will count only 5 extra points. Contacts between Brazilian stations and the Arpoador official station (PY1LCA) will count ony 10 extra points. Contacts between members of the Arpoador club, as well as contacts between members of the Melvin Jones Memorial Radio Club, will not count any bonus points.

AWARDS:

For both categories, the Lions Club International will present trophies for first, second, and third place on both modes. For single operators, fourth through tenth places will receive plaques. In addition, each log sent by participants with a minimum of 15 contacts will receive a special certificate.

ENTRIES:

Keep a separate log for each mode and clearly indicate the operating category. Each particpant will note in the logs the callsign and information exchanged. Confirmation of contacts will be made by comparing the logs of participants. Participants should send their logs by air mail not later than February 15, 1986, to: Contest Committee, Rio de Janeiro Arpoador Lions Club, Rua Sao Francisco Xavier No. 246, Apt. 407, 20551, Rio de Janeiro, RJ, Brazil.

MICHIGAN QRP CLUB CW CONTEST
Starts: 1500 UTC January 11
Ends: 1500 UTC January 12

The contest is open to all amateurs and all are eligible for the awards. This is a CW-only, allband QRP contest. Use all bands from 160 to 10 meters, excluding WARC bands. Each station will be competing within his own state, province, or country in one of the following categories: (1) one Watt or less output power; (2) five Watts or less output power; (3) over five Watts output power.

EXCHANGE:

RST, state, province, or country, plus power output.

SCORING:

Each contest is worth one QSO point. Multiply by the number of states, provinces, and countries worked per band for total points. If operating 100%-natural or battery emergency power, use a bonus multiplier of 1.5 times total points.

AWARDS:

Certificates will be awarded to the highest-scoring station in each state, province, and country.

ENTRIES:

Log information must include: full log data with a separate log for each band, name and address, equipment used, and power output. Logs must be received no later than six weeks after the end of the contest. Please include an SASE or two IRCs for contest results if desired. Send all logs to: Chris Hethorn KM8X, 6818 Meese Dr., Lansing MI 48910.

ARRL VHF SWEEPSTAKES
Starts: 1900 UTC January 11
Ends: 0400 UTC January 13

Sponsored by the ARRL, this is the 39th annual running of this event. As usual, check *QST* for any last-minute rule changes. The object of this contest is to work as many amateurs in as many 2-by-1-degree grid squares as possible, using authorized amateur frequencies above 50 MHz. Foreign stations may only work W/VE amateurs.

Operating categories include: (A) single operator, single band; (B) single operator, allband; (C) multi-operator. Single-band entries may submit QSOs made on other bands for ARRL-affiliated club competition credit. Multi-operator stations must have all equipment and antennas located within a 300-meter-diameter circle.

Use of repeater frequencies or retransmission of either signal is not permitted. This also includes soliciting contacts via 2-meter repeaters or on repeater frequencies. Use of national simplex frequency, 146.52 MHz, or immediate adjacent guard frequencies is likewise prohibited. However, there are no restrictions on the use of 223.50 MHz.

Only recognized simplex frequencies may be used, such as 144.90 to 145.10; 146.49/.55/.58; 147.42/.45/.48/.51/.54/.57 MHz on 2-meters. Local-option simplex channels and frequencies adjacent to these frequencies that do not violate the intent of the above rules or the spirit and intent of the band plans may be used for contest purposes.

Stations may be worked only once per band from any given grid square for credit, regardless of mode. Stations changing grid squares must submit a separate entry for each grid square from which they operate. Crossband QSOs do not count.

Any transmitter used to contact one or more stations may not be used under any other call during the contest period, with the exception of family stations where more than one call is assigned to one location by FCC/DOC. Only one signal per band is permitted at any given time, regardless of mode. While no minimum distance is specified for contacts, equipment should be capable of real communications over at least 1 km. Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs of Technician class or higher using coherent radiation (laser) and employing at least one stage of electronic detection on receive.

Multi-operator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a completely different station must exist for each QSO made under these conditions.

EXCHANGE:

Grid-square locator (see the January, 1983, *QST*, page 49); signal reports are optional. Partial QSOs do not count. Both callsigns, the full exchange, and acknowledgement must be sent and received for credit. Any station located precisely on a dividing line between grid squares must select only one as the location for exchange purposes. A different grid square multiplier cannot be given out without moving the complete station at least 100 meters.

SCORING:

Count one point for complete two-way QSOs on 50 and 144 MHz, two points on 220 or 432 MHz, four points on 902 and 1296 MHz, and eight points on 2.3 GHz or higher. The multiplier is the total number of different grid squares worked per band. Final score is total QSO points times total number of multipliers.

AWARDS:

Suitable awards will be presented to the top-scoring single operator in each ARRL section and on each band in each section for single-band entries. The top multi-operator awards will be made for top scores in each ARRL section where significant effort or competition is evidenced. Multi-operator entries are not eligible for single-band awards.

ARRL-affiliated clubs can compete for gavels on three levels: unlimited, medium, and local. Details are listed in the January issue of *QST*.

ENTRIES:

Logs must indicate time in UTC, bands, calls, and complete exchanges. Multipliers should be numbered clearly the first time they are worked. Entries with more than 200 total QSOs must include cross-check sheets. All entries must be postmarked no later than 30 days after the contest and mailed to the ARRL, Newington CT 06111. Use ARRL VHF SS forms or a reasonable facsimile. Each entrant agrees to be bound by the provisions of the rules, the regulations of his or her licensing authority, and the decisions of the ARRL Awards Committee. Disqualifications will be made for excess duplicates and call-sign or exchange errors.

NORTH DAKOTA QSO PARTY
0000-0800 UTC January 18
1600-2400 UTC January 18
0800-1600 UTC January 19

Sponsored by the Red River Radio Association, contestants may work stations once per band and mode.

EXCHANGE:

Signal report and QTH (county for ND stations; state, province, or country for others).

SCORING:

10 points per phone contact, 20 points per CW contact, and 50 points per RTTY contact. ND stations add 250 bonus points for working 5 Novices. Multiplier for ND stations is number of states/provinces/countries worked. Multiplier for non-ND stations is the number of ND counties worked (53 maximum).

FREQUENCIES:

Phone—1.810, 3.905, 7.280, 14.295, 21.380, and 28.500; CW—1.810, 3.540, and 35 kHz up from the band edges; Novice—25 kHz up from the band edges.

ENTRIES:

Mail logs by February 28, 1986, to Mike Beaton KD0A, 2267 Flickertail Drive, Fargo ND 58103. Include a large SASE for results.

RATS NEST AND CROOKED STICK VI ANTENNA EXPERIMENTER'S CONTEST SPRINT
Starts: 2300 UTC January 18
Ends: 0400 UTC January 19

Sponsored by the Issaquah Amateur Radio Club, the object of this contest is to accumulate QSO points by making contacts using a home-brew wire antenna. The antenna may be in any configuration, as long as it includes the use of a crooked-stick support. Maximum transmitting power is 250 Watts dc input.

EXCHANGE:

Name, QTH, type of antenna, and indicate if IARC member.

FREQUENCIES:

CW—7.050 to 7.150; SSB—7.225 to 7.300.

SCORING:

CW QSOs count 5 points, phone 2 points. Each new state, province, or country counts as a multiplier of two. To encourage "Elmering" and participation of everyone interested in amateur radio, new individuals and old-timers alike, the following bonus has been established: Contacts made with an apprentice's assistance, add 2 points. Contacts made by an apprentice (minor coaching allowed) add 5 points.

AWARDS:

Best CW, SSB, Novice/Tech; best with Rats Nest antenna; best Elmer. There is also a personalized Rat Catcher certificate for contacting three or more IARC members.

ENTRIES:

Submit entries by February 1, 1986. Include summary sheet with points per mode, bonus points earned, total points



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

earned, name, call, address, complete description of antenna and equipment used, license class, and copy of log sheet. Logs to include time, call, frequency, mode, and exchange. Clearly mark three IARC member contacts to qualify for Rat Catcher Award. Send all correspondence and entries to the Issaquah Amateur Radio Club, c/o Steve Pack WB7VAS, 4609 158th Ave. SE, Bellevue WA 98006.

ARRL NOVICE ROUNDUP
Starts: 0001 UTC January 25
Ends: 2359 UTC February 2

The object of this ARRL-sponsored contest is for Novice and Technician operators in the US to exchange QSO information with as many stations as possible on the 80-, 40-, 15-, and 10-meter Novice/Technician bands. Others work Novices and Technicians only. All stations must operate no more than 30 hours during the contest period. Off periods must be at least 15 minutes; listening time counts as operating time. Times on and off must be indicated in your log.

Operating categories include: (A) single operator—one person performs all transmitting, receiving, and logging functions; (B) multi-operator, single transmitter only—those obtaining any form of assistance, such as relief operators or logging.

EXCHANGE:

Signal report and ARRL section or DX country. Novices should send /N and Technicians /T after their callsigns so others will know their license class.

SCORING:

Count one point for each complete two-way QSO. Work each station once, regardless of band. No crossband contacts are permitted. Multiplier is the number of ARRL sections plus VE8/VY1 and foreign countries. Additional points can be earned if you have qualified for an ARRL Code Proficiency certificate (not FCC). CP credit equals the speed in words per minute indicated on the latest certificate or sticker held by the entrant. Final score is computed by adding your Code Proficiency credit to your total number of QSO points. Then multiply that by your ARRL section/country total for your final score.

AWARDS:

Certificates will go to the top Novice and Technician in each ARRL section and each single-operator Novice or Technician who submits a valid entry with 200 or more QSOs. Multi-operator or General-class licensees and above are not eligible for awards.

ENTRIES:

Contest forms are available from the ARRL for an SASE. Official forms are recommended. Any entry making more than 200 QSOs must submit duplicate-checking sheets with alphabetical listings of stations worked. Incomplete or late entries will be classified as check logs. Logs should include dates, QSO times, on and off times, complete exchange sent and received, and band. Postmark entries within 30 days after the contest, addressed to the ARRL, Newington CT 06111. Each entrant agrees to be bound by the provisions as well as the intent of the rules, regulations of his/her licensing authority, and the decisions of the ARRL Awards Committee. Usual ARRL disqualification rules apply.

MICHIGAN YL QSO PARTY
Starts: 1800 UTC January 25
Ends: 1800 UTC January 26

Sponsored by The Auto State Young Ladies (TASYLs). No crossband, net, or repeater QSOs are allowed. Each station can be contacted only once.

EXCHANGE:

RS(T), QTH, and TASYL# (for members).

SCORING:

Score one point per QSO and multiply by 2 if on CW. Multiply again by 2 if TASYL member. Multiply QSO points by number of different ARRL sections and DX countries worked.

ENTRIES:

Send logs to TASYL President Verline Ferris KI8V, 308 E. Harry, Hazel Park MI 48030. Entries must be received by February 28, 1986.

The TASYL Certificate may also be earned during the QSO Party for working TASYL members. Charter Members 1 through 50 count 2 points, while all other members count 1 point. MI stations need 15 points, VE and other US stations need 10 points, and DX or VHF stations need 6 points. To apply for the award send a signed and dated log showing the date and time of contact, callsigns, frequency, RST, and TASYL number. Certification giving date and QTH must be on the original application and signed by one of the following: 2 licensed amateurs, General-class or higher (non-family), one official of a recognized club, or a notary public. Include $1.00 to cover mailing costs, etc., and submit applications to Elaine Matyjaszek KA8KAK, 1127 Hillcrest Dr., Boon MI 49618.

CLASSIC RADIO EXCHANGE
Starts: 2100 UTC January 26
Ends: 0400 UTC January 27

The purpose of this event is to restore, operate, and enjoy older equipment. A classic radio is one which was built since 1945 which is at least ten years old. The same station may be worked with different equipment combinations on each band on each mode. Non-contestants may be worked for credit.

EXCHANGE:

Name, RST, state/province/country, receiver and transmitter type (home-brew send PA tube, i.e., "807"), and any other points of interest.

FREQUENCIES:

CW—up 60 kHz from the low band edges; phone—3.910, 7.280, 14.280, 21.380, 28.580; Novice/Technician—3.720, 7.120, 28.120.

SCORING:

Multiply total QSOs (all bands and all equipment combinations used) by the total number of different receivers, transmitters, and states/provinces/countries worked on each band and mode. Multiply that total by your classic multiplier (total years old of all receivers and transmitters used—three QSOs minimum per unit; if equipment is a transceiver, multiply age by two).

ENTRIES:

Send logs, comments, anecdotes, etc., to Stu Stephens K8SJ, 1407 Hollyrood Road, Sandusky OH 44870. Include an SASE for the *Classic Radio Newsletter* (published twice each year).

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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	–					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15[1]	20[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*						15	15	15	20	20
U.S.S.R.	40		40	40			20	20				

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
*** = Try next higher band.**

G = Good, F = Fair, P = Poor.

JANUARY

SUN	MON	TUE	WED	THU	FRI	SAT
			1 P-F	2 F	3 F	4 P
5 G-F	6 G-F	7 P	8 F	9 P	10 P	11 F
12 G	13 G	14 G	15 F	16 G	17 G	18 F
19 P	20 P	21 F	22 G	23 G	24 F-P	25 P
26 F	27 G	28 G	29 G	30 G	31 G	

Issue #305

February 1986
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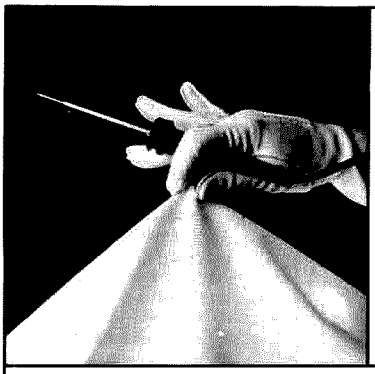
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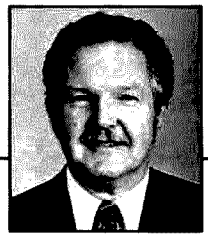
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WHAT?

News from W1XU

As I write, Halley's Comet has recently made its once-in-a-lifetime reappearance in the night sky, and a lot of extra attention by astronomers, photographers, and even the man in the street is being focused on the heavens to catch a glimpse of this infrequent visitor to our solar system. It seems appropriate, therefore, to talk a little about the solar system and its relationship to amateur radio.

Hams aren't strangers to the space surrounding the sun and planets, for we've bounced signals off the moon, relayed messages by satellite, and propagated radio waves through Earth's ionosphere. For years we've known about the sunspot cycle and its effect on radio propagation at high frequencies, and we've been able to calculate seasonal and daily variations in the MUF which affect the likelihood of one band or another being open between two locations on Earth. Although necessary, such information is by no means sufficient, because it does not take into account the day-by-day condition of Earth's magnetic field which so drastically influences our ability to communicate.

The late John Nelson, who prepared propagation forecasts for *73* for so many years, was among the first to suspect (and finally utilize) the surprising influence of planetary positions on propagation to make his astonishingly 80%-accurate predictions. Because Earth is bathed by solar radiation and, in fact, can be considered to be within the solarsphere, ionospheric propagation on Earth is complicated by the extremely variable and often unpredictable nature of the sun, whose nuances of behavior have such a powerful effect on communications. Sunspots, solar flares, coronal holes, and other major events on the sun have long been associated with radio propagation and, in recent years, have been reported regularly by the Space Environment Services Center of Boulder, Colorado, in its weekly report, *Preliminary Report and Forecast of Solar Geophysical Data*. This magnificent and extremely valuable publication is available to anyone for the asking; it catalogs hourly solar events over a period of days. You can find such phenomena as 2800-MHz solar flux, sunspot count, A and K magnetic indexes, flares, and other information of vital interest to radio communicators.

For the past eight years I have kept almost daily records of solar events on a chart which also includes the planetary alignments. Not long after I began recording, I noticed that certain alignments seemed to have a marked effect on propagation. In particular, sharp fluctuations and sudden jumps in the magnetic-field index appeared to be associated with specific alignments, particularly quadratures and inferior/superior conjunctions between some of the planets and the sun. Of even greater interest because of its implications, there seemed to be a relationship between the position of the planets and major or catastrophic events on Earth such as volcanic eruptions, earthquakes, and even hurricanes. Now, I use charts prepared several months in advance to produce the monthly propagation forecasts in *73*.

I feel obliged, in all honesty, to remark that I have not proved anything, although I think I have found some interesting and potentially important correlations. There is no consensus among observers and scientists about planetary influences; in fact, most pooh-pooh them. Nevertheless, it seems possible to me that the planets may "modulate" the sun's electromagnetic field in a manner similar to the moon "modulating" Earth's gravitational field and affecting the tides.

Perhaps it would be of interest to follow an example of the charting process from which I make the predictions. Using *The Astronomical Almanac* (available from the US Government Printing Office), I make a simple graph which has degrees on its horizontal baseline and days of the month along its vertical left margin. The degrees run from 0-90, 90-180, 180-270, and 270-360, with each 90-degree range lying exactly underneath its neighbor. In this way I can obtain quadratures (90-degree relationships), inferior conjunctions (180-degree relationships), and superior conjunctions (0-degree relationships). I then read the position of each planet from the *Almanac* and plot its location in heliocentric degrees along the baseline for the first day of the month and along the top line for the last day of the month. It is then a simple matter to connect these locations with a straight line. Where planetary position lines cross one another, there is an alignment, and their angular relationship is obvious.

Next, I take the day of each alignment and place it on another (master) chart as a vertical line according to the day on which it will occur. The days run along the abscissa on this chart, with ordinates representing values of solar flux, magnetic-field index, and the like. The master chart is then filled in with the data as the information becomes available from WWV or from the previously-mentioned *Solar Geophysical Data*. I plot the dates of moon perigee and full moon as well. After several weeks of plotting the data points and connecting them with the various colored lines, one can see relationships between solar (and Earth) events as they coincide with the planetary alignments. I have to admit that much of this can be (and probably has been) computerized to reduce the amount of time required to prepare the charts.

The chart becomes a running record of events versus planetary positions, and it is fun to see the relationships develop with time. For example, the eruption of the volcano in Colombia on November 13th coincided with a 90-degree alignment of Earth and Jupiter, an inferior conjunction of Earth and Mercury, a 90-degree alignment of Mercury and Uranus, and a 90-degree alignment of Mars and Uranus. Interestingly, the sunspot count jumped from zero on the 3rd to 50 on the 13th and

Continued on page 69

MPA

73 for Radio Amateurs is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 57 computer publications in more than 20 major countries. Nine million people read one or more of the group's publications each month. Members of the group include: Argentina's *Computerworld/Argentina*; Asia's *The Asian Computerworld*; Australia's *Computerworld Australia, Australian PC World, Macworld* and *Directories*; Brazil's *DataNews* and *MicroMundo*; China's *China Computerworld*; Denmark's *Computerworld/Danmark, PC World* and *RUN* (Commodore); Finland's *Mikro*; France's *Le Monde Informatique, Golden* (Apple), *OPC* (IBM) and *Distributique*; Germany's *Computerwoche, Microcomputerwelt, PC Welt, SoftwareMarkt, CW Edition/Seminar, Computer Business, RUN* and *Apple's*; Italy's *Computerworld Italia* and *PC Magazine*; Japan's *Computerworld Japan*; Mexico's *Computerworld/Mexico* and *CompuMundo*; The Netherland's *Computerworld Benelux* and *PC World Benelux*; Norway's *Computerworld Norge, PC World* and *RUN* (Commodore); Saudi Arabia's *Saudi Computerworld*; Spain's *Computerworld Espana, Microsistemas/PC World, Commodore World*; Sweden's *ComputerSweden, Mikrodatorn* and *Svenska PC*; the UK's *Computer Management, Computer News, PC Business World* and *Computer Business Europe*; Venezuela's *Computerworld Venezuela*; the US's *Computerworld, Hot CoCo, inCider, Infoworld, MacWorld, Micro Marketworld, PC World, RUN, 73, 80 Micro, Focus Publications* and *On Communications*.

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QRX. . .

EDITED BY PERRY DONHAM KW1O

New Sats

THIS MONTH should see the launch of two new Soviet amateur satellites, RS-9 and RS-10. Both will be in orbits similar to the current set of RS satellites, with a period of about 2 hours. RS-9 will carry only a Mode A transponder (2m up, 10m down). RS-10 will have three transponders: Mode A, Mode K (15m up, 10m down), and Mode T (15m up, 2m down). The 2m beacon will be at 145.557 MHz. Also expected is the ejection of ISKRA-4 from the space station Salyut-7; the satellite will carry a Mode K transponder and will circle the earth every 92 minutes for just a few months.

Ham Stats

THE LATEST FIGURES released by the International Amateur Radio Union (IARU) concerning the number of licensed amateurs in the world are very interesting. In order of ham population, the top ten countries are: Japan (no surprise there!), the United States, the USSR, Brazil, the United Kingdom, the Federal Republic of Germany, Italy, Spain, Argentina, and Canada. I was really *amazed* that Yugoslavia or Czechoslovakia wasn't right up there—seems like every time I tune across 20 meters the band is just *full* of OKs and YUs! When ranked by the number of hams who are members of their national society, the list looks like this: the Federal Republic of Germany on top with 77%, the United Kingdom in second place with 51%, Spain right on the UK's heels with 50%, Italy with 37%, and the United States in fifth place with only 27%. All told there are 1,511,000 amateur-radio operators in the world.

Waivers Waived

THE FCC HAS DENIED two requests for waivers of the rules covering volunteer examinations. **Jim Gustafson 5Z4JD** asked permission to conduct an exam session with one Advanced- and two Extra-class hams (the rules require three Extras). In denying the petition, the Commission said, "To establish such a precedent by waiving the requirement could easily lead to many similar requests, all of which would attempt to show a unique circumstance which would tend to make compliance with the three-VE requirement a hardship." (Ever notice how it takes the FCC a full paragraph to say, "No"?) **John Mulville KA0TNS** filed the other request. He asked for a waiver of the 13-wpm Morse test, citing a medical condition that would impair his ability to copy code. Said the Commission, "That requirement is so basic to the Amateur Service that waivers of it *are not granted*."

AL Together Now

COMPLAINING THAT, "Alabama has been made an island," repeater owners in that state have petitioned the **Carolina Virginia Repeater Association (CVRA)** for membership. Several months ago the Alabama Repeater Council directed all repeater owners to move immediately to a 20-kHz-spacing plan or lose their coordinated status ("QRX," June, 1985), even though surrounding states use a 15-kHz plan. Now the owners want to be coordinated on a regional rather than state basis, and are forming what will be the Alabama district of the CVRA. If the CVRA approves the petition, a thorough survey will be taken of all repeater operators in the state to determine whether or not a move back to 15-kHz spacing will be made. The CVRA coordinates repeaters in Georgia and Tennessee as well as the Carolinas and Virginia; Mississippi also is considering joining the organization.

Winner

INADVERTENTLY LEFT OUT of our 1985 75m World SSB Championship results was **Dr. Max de Henseler HB9RS**, president of the United Nations Amateur Radio Club. Max piloted **4U1UN** to a Class A Single-Op win with 520 QSO points and 22 multipliers for a total of 11,440 points. Max will receive a certificate for being the top scorer in his country (in fact, 4U1UN is the *only* station in that country. . .a guaranteed win!). By the way, if you contacted any two of the three UN "countries" last year, you are eligible for the **United Nations at 40 Award**. (The three calls are 4U1UN United Nations Headquarters, 4U1ITU Geneva, and 4U1VIC Vienna.) Drop a note to any of the three at its *Callbook* address.



The shack at 4U1UN.

DXCC + 1?

SPEAKING OF single-station countries, why not add the Council of European Headquarters in Strasbourg, France? Gus Browning, in his *DX'ers Magazine*, says that the station will have extraterritorial status, just like all of the United Nations buildings. Look for the prefix **TP21**—I'm sure the DXCC desk will be eager to add a "new one." Gus also mentions that VK3SX is looking for just a few more states to complete WAS on 40m: Arkansas, Delaware, Hawaii, Idaho, Nebraska, Nevada, New York(!), North Dakota, Oklahoma, Oregon, and West Virginia. Want to help him out? Drop a line to Bob Robinson VK3SX, 81 Bishop St., Yarraville 3013, Melbourne, Australia.

AM Appeal

THE US COURT OF APPEALS has upheld a decision by the FCC which sets the maximum amateur output power at 1500 Watts PEP. **Glenn Baxter K1MAN** fought the rule in court, claiming that it would adversely affect double-sideband operation by halving the maximum output (currently it is 3,000 Watts—the Commission has postponed the implementation of the 1500-Watt rule for DSB until 1990). Baxter can now appeal his case only to the US Supreme Court.

Opening

***73* MAGAZINE** has an opening on the editorial staff for a Technical Editor. If you are interested in living and working in the tax-free hills of New Hampshire, send your resume to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: Jack Burnett.

OSCAR Orbits

PROJECT OSCAR has prepared a complete set of orbital predictions for 1986. The tables list the time and longitude for all north-to-south equatorial crossings of RS-5, RS-7, and the two University of Surrey satellites (OSCAR 9 and OSCAR 11). Also, the time, sub-satellite latitude and longitude, and argument of perigee are given for the apogee of each orbit of AMSAT-OSCAR 10. Project OSCAR also has prepared *The AMSAT Phase III Satellite Operations Manual*, a 110-page book covering operating procedures and technical

details of the new series of OSCAR satellites. The orbital listings are available for a $10.00 donation and the manual for a $15.00 donation: Send your orders to Project OSCAR, Inc., PO Box 1136, Los Altos CA 94023.

QSL Liberty

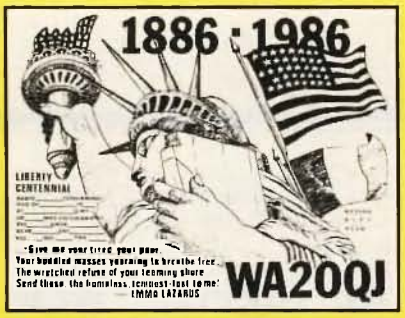
THE FIRST ENTRANT I've seen in the Statue-of-Liberty-Centennial-QSL department is a really nice one from **Al La Vorgna WA2OQJ**. Al's card is 8" × 10", and you can get one by working WA2OQJ any time during 1986. Al says that he is RTTY-active on both 20m and 2m and also is on packet. Anyone else issuing a commemorative card this year? Let me know!

MetroSat

WHOEVER IT WAS that came up with the name "Amateur Radio" must be doing some double takes these days—our hobby is far from amateur! And just when you thought packet radio was the hottest item on the ham menu, along comes the **Metroplex Network**. The Network is a satellite-based news system designed expressly for amateur radio. Three programs, co-produced by Metroplex and Westlink Radio, are now being transmitted: a weekly news show, a weekly swap-and-shop service, and three North American Teleconference Radio Nets per year. Affiliated club stations can downlink the shows from a commercial satellite transponder for a fee, receive them via a UHF link, or connect to the network over the telephone. A new package is available every Monday night at 10:00 pm EST. Alex Magosci WB2MGB can give you more details about network affiliation—get in touch with him at the Metroplex Network, PO Box 237, Leonia NJ 07605, or call (201)-592-7614 for a taped message.

On The Table

YOUR CHANCE to get a real picture of Comet Halley taken from a real observatory by a real astronomer is coming up this month. **Jim Young WB6FNI**, resident astronomer at the Jet Propulsion Laboratory's Table Mountain Observatory, will commemorate the celebrated slushball by operating from Table Mountain during February and March, 1986. Jim says that this will be a forty-meter-only affair and will be done on a noninterference basis with normal observatory activities. Frequencies (in MHz), modes, and times (in UTC) are: 7.120 CW 0400-0500, 7.228/7.077 SSB (split for DX to Europe and Africa) 0500-0600, 7.249 SSB 0600-0700, 7.249 SSB (on the Triple-H Net) 0700-0800, 7.228 SSB (looking for South Pacific, Australian, and New Zealand stations) 0800-0900, and 7.228/7.084 SSB (split for DX to Asia and the Far East) 0900-1000. Jim will answer your QSL with a certificate and an original Halley's Comet photo taken from the Table Mountain Observatory. Send your card and a #10 SASE (with 40¢ postage) or 5 IRCs to Jim Young WB6FNI, PO Box 576, Wrightwood CA 92397.



Al WA2OQJ's commemorative QSL.

Pollish Hams

OUR 6TH ANNUAL "Fun!" poll is here! Conducted by columnist **John Edwards KI2U**, this year's survey probes the collective psyche of ham radio with questions such as, "Should hams be subject to periodic retesting?" and, "Do you think nets have a place in ham radio?" This is your chance to directly effect changes in *73*—we take the results of this poll very seriously and use them to determine just what it is that our readers want to see in the magazine. This year, you can send your answers to John electronically through CompuServe (70007,412) or The Source (CPA117). See you at the polls!

Write On!

HAVE YOU EVER read an article in *73* and said to yourself, "Gee, I could do that!"? You're right—you could. In fact, we're *asking* you to write an article for us! And, as a special bonus for "QRX" readers, I'll give you a few inside tips that will help sell your manuscript. First, pick a topic that hasn't been beaten to death already. For example, a logging program for your computer probably will not make the grade. Statistically, the most-accepted topics are antenna construction and modifications. Second, include plenty of photographs—a good picture can sometimes sell an otherwise dull article. Include captions for your shots on a separate sheet, and lightly, with a pencil, mark the back of each print with a letter or number. Third, be yourself. Just write down your ideas as you would say them to someone standing in the room with you—long words and complicated phrases just make a manuscript hard to understand. Finally, if you can't come up with an article, try writing a review. It doesn't have to be a component-by-component engineering analysis, just a summary of what you liked and disliked about the product. Again, take plenty of pictures. If you want a step-by-step guide to becoming a *73* author, send an SASE to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: How to Write.

Think Thinkers

THE COMPUTER MUSEUM in downtown Boston, in conjunction with Computer-Land and CW Communications, is searching for relics left over from the early days of computing. They are looking for just about anything that smells of mold: kits, cards, one-of-a-kinds, and memorabilia. If your item is selected to become part of the exhibit on computer evolution, you'll receive an invitation to the grand opening and a bound copy of the exhibit catalog. If yours is one of the "fantastic five" pieces, as determined by a distinguished panel of experts, the Museum will pay your way down to Beantown (and home again) for the big opening bash. Get in touch with the Museum for an official entry form, or just mail a picture and a description of your entry to The Computer Museum, Personal Computer Competition, 300 Congress Street, Museum Wharf, Boston MA 02110; (617)-426-2800.

Packet Paper

GWYN REEDY N1BEL dropped by the office recently to tell us about a new magazine for packet-radio enthusiasts, called (appropriately) ***Packet Radio Magazine***. The magazine is an extension of the Florida Amateur Digital Communications Association's *FADCA>Beacon* (a *73* Newsletter of the Month winner) and will be distributed nationwide. Space will be made available in each issue for local clubs to use; Gwyn says that this arrangement will let local groups use *Packet Radio* as their club "newsletter" and will also keep packet organizations around the US up-to-date on each other's progress. If you or your club is interested in *Packet Radio Magazine*, get in touch with Gwyn at FADCA, Inc., 812 Childers Loop, Brandon FL 33511.

Friends

"QRX" was brought to you this month with the help of the *W5YI Report, Amateur Satellite Report,* the *FADCA>Beacon,* Gus Browning's *DX'ers Magazine,* and *Westlink*. Don't forget to send your news items and photographs to *73* Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458.

John L. Rehak N6HI
8701 MacAlpine Road
Garden Grove CA 92641

Razor-Sharp CW

Here's a filter for fanatics—or is 80 Hz too wide?

The Kenwood TS-430S is without doubt one of the best of the smaller mobile-size HF transceivers on the market today. With its many modes and logical memory-control operation, it is truly excellent for mobile operation. *All* of my operation is mobile . . . and CW is my preferred mode. My work as a traveling salesman requires me to spend many hours behind the wheel of my car each week, and my mobile CW operations make those hours fun instead of boring!

With my primary interest being CW, I saw only one small deficiency in the operation of the TS-430S on CW: Kenwood did not make any provision for installation of an active audio filter for improved reception. I tried their 270-Hz i-f filter, and although it is nice as i-f filters go, it is no substitute for a good narrow active audio filter. (Having both is ideal!)

I have been building and using active audio filters for CW receivers for years and have long since recognized their performance advantages. I made the decision to modify my TS-430S even before I purchased the rig.

Squeezing In a Filter

When I unpacked my brand-new rig, I gave it only a quick check to ensure that its "stock" operation was without problems before I removed the cabinet covers and started searching for an area within the rig that would have the spare room to install a good CW filter. I found several good possibilities and, for my unit, decided on the area directly under the top cover and to the left, just in front of the filter unit (X51-1290-00—see instruction manual, page 27).

This is a fine location as long as you keep the CW filter board low profile (lay resistors and "long" components down on the board; don't stand them on end). Another good possible location would be the space allocated for the optional FM-430 (FM mode unit)—if you do not have the FM unit installed and do not plan to do so.

Circuit Details

The schematic diagram of the CW filter I developed for the TS-430S is shown in Fig. 1. The circuit consists of four stages of active bandpass filtering provided by two type-uA747 integrated-circuit dual op amps and includes a simple threshold detector (diodes D1 and D2) between stages 2 and 3 to reduce low-level background noise. Each of the four filter stages acts as a narrow bandpass filter with an audio bandpass centered at 750 Hz.

The four stages together result in an excellent and extremely narrow CW filter that will pass a 750-Hz CW note with no attenuation but will reject adjacent signals so well that an audio note below 600 or above 900 Hz can barely be heard. The actual measured 3-dB bandwidth is only 80 Hz wide . . . truly a "razor sharp" CW filter!

I strongly suggest using polycarbonate or other temperature-stable capacitors for each of the eight .001-uF capacitors, with a capacitance tolerance of ±5% or less, to ensure that each of the four stages of filtering will be correctly tuned to identical bandpass frequencies. If you are a real calibration fanatic, you can tweak the bandpass frequencies of each stage by adjusting the value of its 27k resistor. (In-

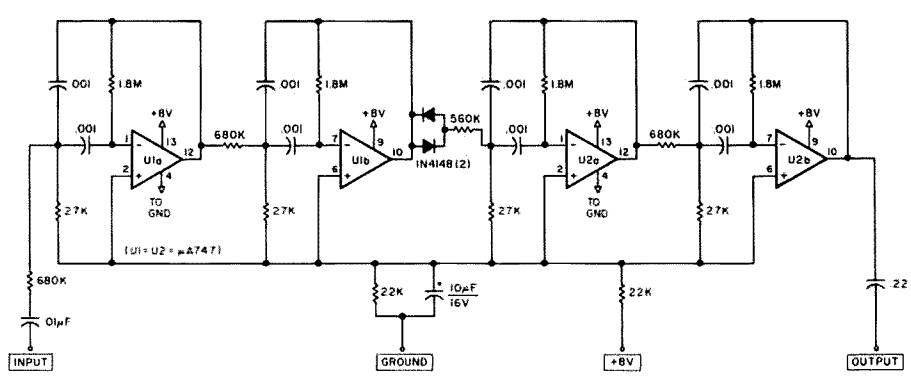
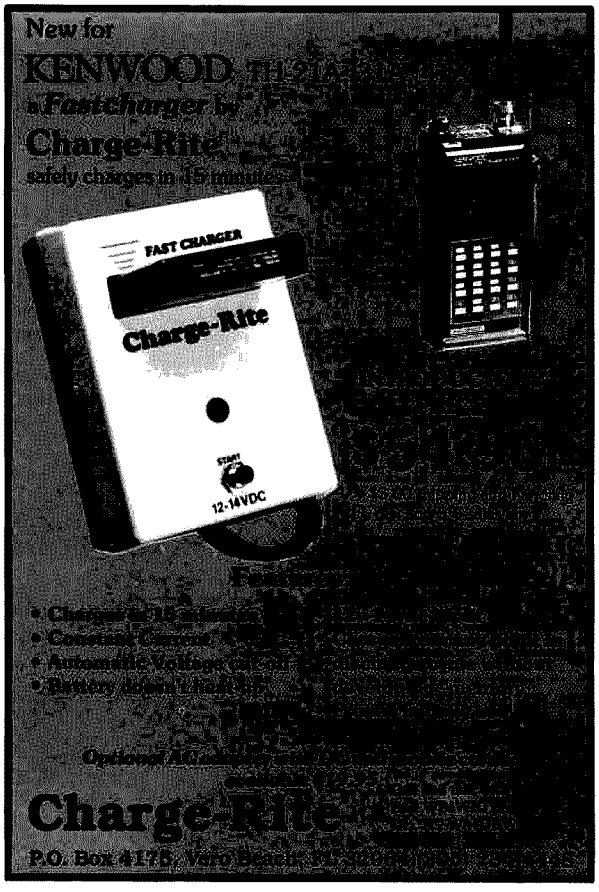


Fig. 1. Schematic diagram.



creasing the resistance will lower the bandpass frequency.) In actual practice, you will probably find that the four stages don't really have to be *perfect*. . . just close enough so that all four stages will pass the desired audio frequency of 750 Hz.

I constructed my filter on a small piece of perfboard, with components on one side of the board and small-gauge insulated wires forming all interconnections on the reverse side.

Initial Checkout

After completing the circuit construction, it would be a good idea to verify the circuit's operation before installation in your TS-430S. Using a 9-volt battery for power, connect the filter input to the rig's headphone output and listen to the filter output with high-impedance headphones, tuning across a carrier or CW signal to ensure that the filter passes a clean sounding signal at about 750 Hz but rejects it when you tune higher or lower. If all has gone well so far, you are undoubtedly very impressed with this filter and your handicraft by now, and you *may* elect to stop right there and use the filter board with the nine-volt battery. Feel free to quit here and build the filter into a small box to use as is with any rig and headphones, if you like.

Installation

Like me, you will probably prefer to build this filter right into the TS-430S since this saves having to carry an extra box with you and allows the great convenience of a feature which can be switched in and out as needed and will drive the TS-430S speaker as well as headphones.

The installation I will describe is simple and will end up with the filter operating as if Kenwood had designed it in yet will allow you to easily "un-modify" the rig at any time in the future if you want to sell it "stock" and keep your super little filter to install in a *new* rig.

The filter, as I installed it, will modify the operation of the front-panel ALC/IC meter switch so that it becomes your new audio filter in/out switch. I elected to use this switch (leaving the transmit meter permanently in the IC mode) because I never use the ALC position anyway. This is a very small price to pay to have the CW filter switch in the ideal position!

You may prefer to use something else, such as the noise blanker switch, or whatever, but using an existing switch means you won't have to drill any holes in that beautiful front panel to mount a new one.

For the actual circuit-board mounting, I took the easy way out. Rather than drilling holes, I just enclosed the circuit in a small plastic bag with the four interconnecting leads coming out one corner and let the whole assembly float in the left-rear corner of the rig. It is confined in its location by nearby components yet can't possibly short to anything through the plastic.

Here is the installation procedure for the TS-430S in 5 easy steps:

(1) Unplug connector 4 on the i-f board. Connect Ground from the filter board to pin 2 on connector 4. Remove pin 4 from connector 4 and connect *board pin* 4 to a long insulated wire *and* to Input on the filter circuit.

(2) Unplug connector 14 on the i-f board and connect:
- —connector 14 pin 1 to the long insulated wire you connected in step 1
- —connector 14 pin 2 to connector 4 pin 4
- —connector 14 pin 3 to Output of filter circuit

(3) Connect +8 volts from the filter circuit to pin 3 of connector 7 on the i-f board.

(4) Disconnect blue wire from the (+) side of the S-meter, tape over the wire end so it will not short to anything, and tuck into nearby wiring.

(5) Connect an insulated wire from the S-meter (+) connector to i-f board connector 14, board pins 2 and 3. This completes the installation.

Note: In the TS-430S instruction manual, i-f board connector 14, *in the i-f board schematic*, IC is shown incorrectly as being on pin 1. It should be pin 3—as is correctly shown on the *main schematic* in the manual.

Operation

If you are not now used to operating CW with a filter such as this one, you may find that you will need to change your operating style just a bit. This filter is so narrow that if you tune rapidly across the band with the filter switched in, you will completely miss some signals.

In my normal operating practice, I tune through the band with the filter switched out, then switch it in when I want to really focus in on a particular CW signal. Once that signal is in your filter, you can hit the frequency-lock button on your TS-430S and you really are locked on that station. As long as he does not have a frequency drift on his signal, you will not have to touch your rig again, and you will most likely never hear any other stations during your entire QSO unless you elect to switch the filter out to see what is happening around your frequency.

This modification has certainly increased my enjoyment of CW operating, and I'm sure you will find that having a filter like this in your TS-430S will encourage you to operate a lot more CW. If you also install the optional Kenwood narrow i-f filter (270 Hz), the winning combination will offer CW selectivity second to none! ■

New Bands for Old Rigs

Internal or external, converter or transverter, here's how to add three WARC bands to your favorite radio.

Charles Bryant GW3SB/G3SB
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Minehead, Somerset TA24 5JP
England

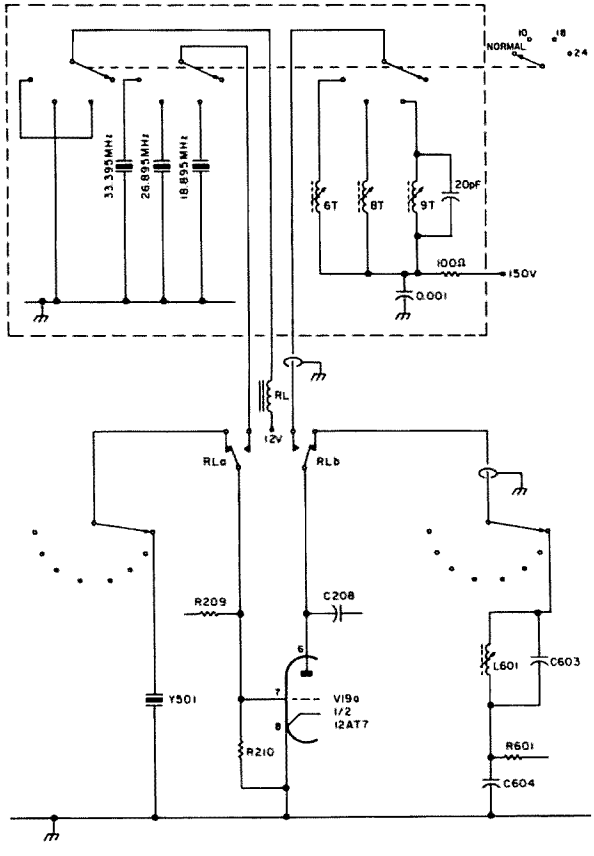


Fig. 1. Modified hfo circuit of the HW-101. Third-overtone crystals are used, inductances wound on 7mm formers with turns spaced the diameter of the wire.

With the 10-MHz band in worldwide use and more countries coming on 18 and 24 MHz each week, now is the time to think seriously about getting started on the WARC bands—if you haven't already done so!

The easiest way is to buy a new rig, and many amateurs are doing just this, with the result that there are some very good five-band rigs on the market at reasonable prices. However, it is not too difficult to find a way of modifying an existing five-band rig to cover eight bands. There are at least three methods of doing so, and this article reviews the advantages—and the snags.

Internal Modification

The most elegant method is to make an internal modification, but this is usually quite difficult. If your rig is a transceiver with provision for the reception of WWV on 10 MHz, it is not too hard to change the connections to allow transmission also. Many owners of popular rigs, such as the FT-101 series, have done so. However, some rigs provide for reception of WWV on another frequency, and these rigs are not so easily changed.

It may be thought that with the low sunspot count, the whole of the 28-MHz band is not required and some of these circuits can be changed. This looks attractive *provided* that the switching arrangements allow. I have found that most rigs use a single set of inductors in some circuits for the whole of the 28-MHz band. The alterations would therefore be extremely complicated, and a different approach would be much easier.

Although I have not tried it myself, the modification of the Heath HW-8 should be fairly simple. Because band changing is accom-

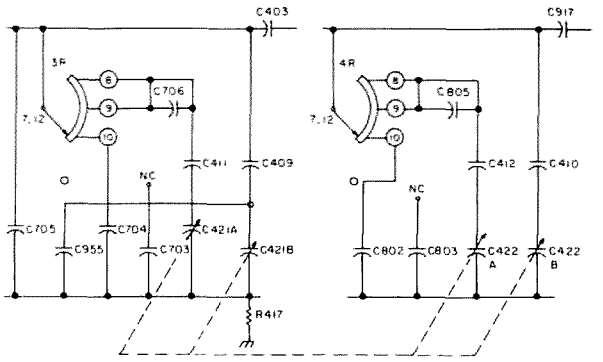


Fig. 2(a). Tuned circuits (inductors omitted) of driver input and output before modification.

plished by push-button on/off switches combined with diodes, all circuits can be isolated effectively when all the bandswitches are in the off position. Three more complete circuits can be constructed and mounted on a board fixed about ½" below the existing PCB. Each separate circuit should be positioned as close as possible beneath the corresponding one on the PCB. It may be necessary to make the cabinet a little deeper and, of course, it will be necessary to add three new switches with their associated diodes. Incidentally, the same arrangement could be used to add the 1.8-MHz band to this popular QRP rig.

Converter—Transverter

If you use a separate receiver (or are prepared to use your existing transceiver in the receive mode only) the use of a converter in front of the rig is the obvious method. Circuits for converters are common. LA8AK (in *Radio Communication*, May, 1983, page 427) and DL1ZB (in *SPRAT*, Summer, 1983, pages 9-11) have suggested that by using a single 4-MHz crystal, the 10- and 18-MHz bands are covered with the main receiver tuned to 14 MHz, and the 24-MHz band can be found with the receiver tuned to 28 MHz.

At least for the CW operator, it may prove easier to build a simple CW transmitter for use with the main rig, plus a converter.

There is no reason why a transverter should not be used. For QRP operators this course is possible and circuits have been published. As transverters are really practicable only at low power, this method is likely to appeal only to the QRP fraternity (the circuits I have seen have all been designed for a power of 10 W or under).

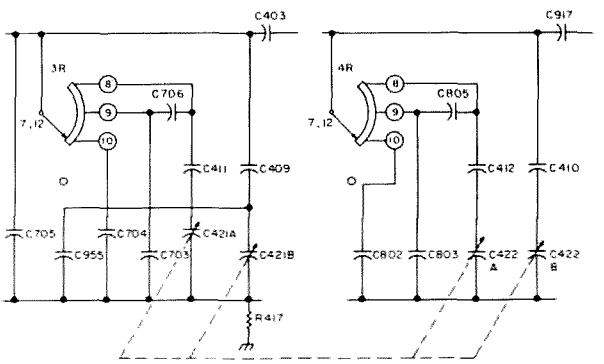


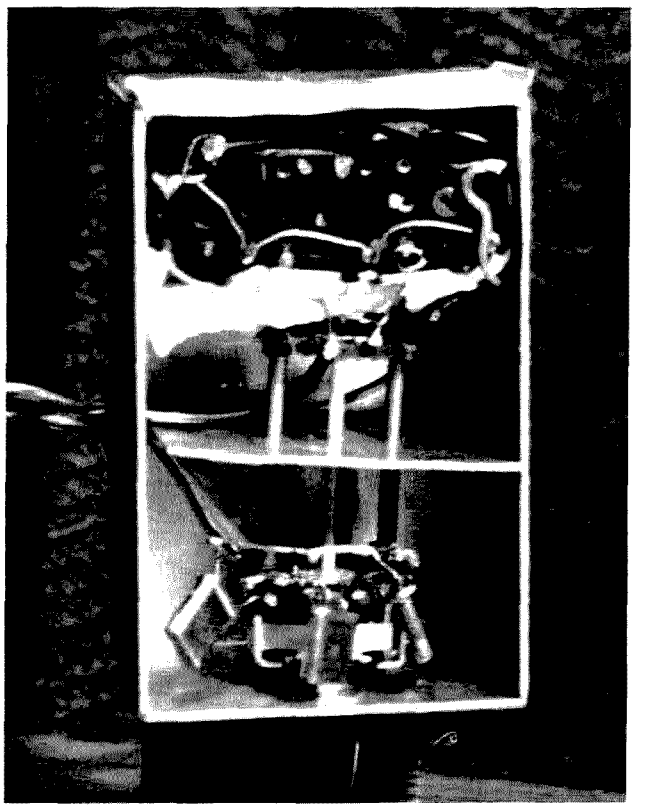
Fig. 2(b). Tuned circuits (inductors omitted) of driver input and output after modification to enable 7 and 10 MHz to be tuned with one inductor.



The new hfo circuits and switch are in the small box to the right of the HW-101.

External modification

This is the method I have used and which will, in most instances, prove to be the easiest approach. The modification consists of breaking the connections from the crystal and tuned-circuit switches of the hfo and inserting a small changeover relay to allow either the existing circuits or new ones, contained in a small external screened box, to be connected to the oscillator. If the rig has a source of 12 V dc, there is no difficulty in providing excitation for this

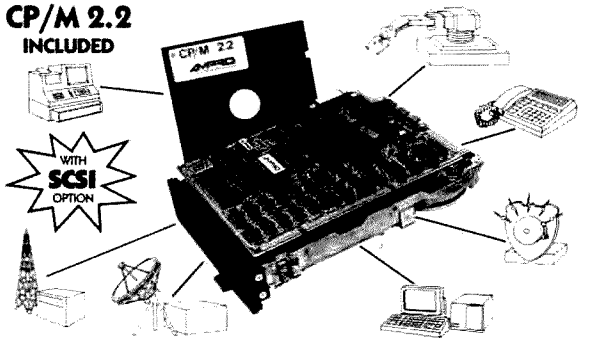


Inside the box containing the new hfo circuits and switch.

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relay. In the case of older rigs, a couple of diodes and a 100-uF capacitor can be connected to the 12-V heater line to provide the necessary dc. It does not matter whether the positive or negative line is connected to ground.

In *Radio Communication* for April, 1982, on page 317, I described my modification of the Heath HW-101 to include the three new bands. This is an expanded version of my original proposals. One advantage of this modification is that it does not involve any mutilation of the equipment, which can, if necessary, be restored to its original form.

The new bandswitch, with associated components, is assembled in a small screened box with an internal screen between the wafers. The size of this box depends on the size of the switch. I used wire-ended crystals which were soldered directly onto the switch, but sockets and plug-in crystals could be used if desired. The components in the other compartment are all supported by their wiring. The simplicity of the circuit is shown in Fig. 1, where component values are placed against *new* components and the existing components are shown with the reference numbers given by Heath.

The leads from the screened box to the rig should be as short as possible. The lead to the tuned circuit must be of miniature coax, but the lead in the crystal circuit and the relay lead may both be unscreened. Originally, I used coax for the crystal lead, but the additional capacitance caused difficulties. To avoid drilling the cabinet of the HW-101, the leads may be fed through the ventilation holes in the bottom of the cabinet. In operation, the box is placed alongside the HW-101.

The relay is positioned as near to the underside of the socket of V19 as possible. The existing black lead passing through hole Z on the "bandpass circuit board" should be unsoldered and rerouted through hole TP so that it may be connected to the relay. All the connections to the relay are thus quite short, and there should be no appreciable change to the operating conditions on the old bands. However, some realignment is necessary before the new bands can be tuned.

By juggling with the slugs in both sets of driver coils (L705, L704, L703, L702, L805, L804, L803, and L802), it is possible to tune to 24 MHz with the "driver preselector" near maximum capacitance and 28 MHz with the capacitor near minimum. Similarly, 18 and 21 MHz can be covered together without any difficulty. A problem arises on 7 and 10 MHz because the capacitance swing is insufficient to cover both bands. The solution to this problem lies in disconnecting C703 from contact 9 of wafer 3R on the "driver grid switchboard" and joining contact 9 to contact 8. Similarly, C803 should be disconnected from contact 9 of wafer 4R on the "driver plate switchboard," and contact 9 should be joined to contact 8. Although this sounds very difficult, a glance at Figs. 2(a) and 2(b) will explain what is involved.

These modifications allow 7 MHz to be tuned near maximum capacitance and 10.1 MHz near minimum capacitance. However, a word of warning: *8.6 MHz also tunes at an intermediate position*. It is essential to make sure that the tuning is correct before transmitting, and a simple test is available. If changing the switch from "normal" to "10 MHz" does *not* affect the signal being received, then the "driver preselector" is wrongly tuned to 8.6 MHz.

I have had no difficulty since making the original modification in 1981, and the performance on the old bands (except the high part of 28 MHz) has not been affected. I should, however, point out that I work exclusively on CW; there may be difficulties on SSB if the output circuit is not optimum. There is also the additional point that the tuning of 24 MHz and 28 MHz in one circuit will result in a considerable reduction of drive on the higher parts of the 28-MHz band.

I have described this modification in some detail, and owners of HW-101s should have no difficulty in duplicating my modification. Owners of other equipment may well feel encouraged to attempt a similar approach.

Antennas

Having got your rig on the new bands, there is no need to erect a new antenna in order to try it out. Use your existing 3.5-MHz dipole (trap dipoles are not recommended) or G5RV antenna. This may not be the perfect answer, but it will get you out on the bands. ■

Parts List

1—Aluminum box, 10 x 5 x 5 cm with lid and internal screen
1—3-bank, 4-position rotary switch with knob
1—18.895-MHz third-overtone crystal
1—26.895-MHz third-overtone crystal
1—33.395-MHz third-overtone crystal
3—7mm coil formers with iron cores
1—0.001-uF capacitor
1—20-pF capacitor
1—100-Ohm resistor
1—12-V operating miniature double-pole changeover relay
Miniature coax and other connecting wire

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Are you tired of replacing the silver-oxide memory backup cells in your Azden? Have you discovered the hard way that the PCS-2000 draws nearly 20 milliamps from your automobile battery when the power switch is off? Do you sometimes find yourself wishing there was an easy way to quickly sample the repeater input frequency when receiving? How about some hang time when in the scan mode; wouldn't it be nice if the receiver would pause for a few seconds after the repeater dropped off, to allow for that slow-to-respond fellow? This article deals with all these problems and more, with some easy and reliable modifications.

Disassembling the Control Head

All the changes described in this article are made within the control head itself; no changes are made to the main radio chassis.

Separate the control head from the main chassis. Remove the top and bottom plates; there is a single screw on each side of each panel. (Page 17 of the Azden instruction manual shows this procedure.) Now remove the four screws on the back plate; also remove the single chrome-plated screw in the right rear corner of the control board. This will allow the rear plate to dangle on the speaker-jack leads. This jack must be removed to allow room for the addition of the battery pack as described in a later paragraph. Unscrew the speaker jack from the rear plate; set the three cover plates and all the screws aside.

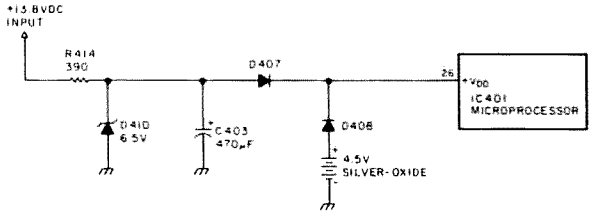


Fig. 1. Original memory-protection circuit uses three silver-oxide cells and charge-protection diode D408 to apply power to the microprocessor while the main power is off.

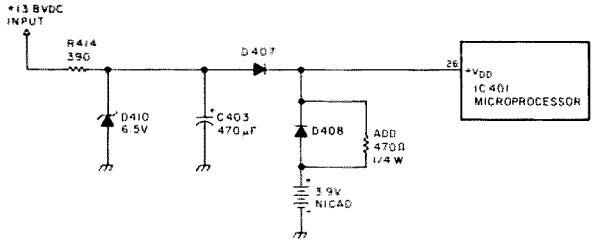


Fig. 2. Modified memory-protection circuit uses a three-cell nicad pack instead of the silver-oxide cells. Adding a 470-Ohm resistor across D408 allows the nicad pack to charge whenever the radio is operated.

Adding a Nicad Battery Pack

The first change we can make is to replace those expensive little silver-oxide cells with a nickel-cadmium battery pack which is recharged every time the transceiver is used. The original circuit (Fig. 1) has diode protection (D408) for a depleted or shorted cell, but this same diode also blocks any charging current to the memory battery (we wouldn't want to try to charge the silver-oxide cells). As shown in Fig. 2, the simple addition of a resistor across D408 will allow charging current to flow into the battery when the power switch is on.

The battery pack should be a three- or four-cell pack, readily available, and small enough to fit into the confines of the Azden control head. The available space is large enough to hold a cylindrical battery approximately 3/4 of an inch in diameter and up to 2-1/8 inches long. I chose a common pager battery made of three cells (nominally rated at 3.9 volts, 140 mA hours). The battery is Motorola part number 60D83009H02 and can be obtained at any authorized Motorola Service Center (they are numerous); they should also be available from any service shop that repairs pocket pagers. Since a very large number of these batteries is manufactured each year, the price is quite reasonable; they sell for less than ten dollars each. This is just slightly more than the price of one set of consumable silver-oxide cells.

After obtaining the battery pack, a set of leads must be attached. *Do not* try to solder the leads directly to the battery. Unfortunately, this battery is not equipped with solder tabs, but with a little effort and thought, a reliable connection can be made. One way of attaching leads is to solder a small

solder lug to the end of each of the two leads and then tape the lugs in place against the ends of the battery, forming a homemade battery holder. (I placed small pieces of foam rubber on top of the lugs and underneath the tape as a sort of spring to ensure a good, firm connection at all times.) The lugs should be plated rather than bare copper. This will ensure trouble-free contacts in the future. Wrap the whole assembly in tape or kraft paper to guard against short circuits; remember this pack must squeeze into a small space in close proximity to the foil side of a printed circuit board.

We must next modify the circuit of Fig. 1 to allow the battery to be charged. Locate D408; it is on the main control board just to the left of the old battery holder. Solder a 470-Ohm, ¼-Watt resistor across this diode. This should be done on the component side of the board if you plan to implement the other modifications in this article. If the leads are pre-tinned, it is quite easy to tack the resistor right onto the leads of the diode.

Finally, the battery pack must be soldered into the circuit. (If you plan to make more modifications, it will be easier if the battery is not yet attached to the control head.) Before the battery is installed in the head, it is a good idea to charge it; most nicad batteries are at least partially discharged when purchased due to their relatively short shelf life. Charge the battery by applying 12 to 14 volts through a 1000-Ohm, ¼-Watt resistor for at least ten hours. Now pre-tin the leads and the two clips on the old battery holder. Try to attach the wires slightly down the sides of the clips because there is very little clearance between the clips and the top plate when it is restored. The battery leads can be soldered to the back side of the board, but this area is best reserved for some of the following modifications. The battery fits vertically in the space directly behind the scan-mode switch.

Battery Capacity and Life

The 470-Ohm resistor in combination with the nominal 4-volt battery causes about 3.6 milliamps of charge current whenever the power switch is turned on. The memory-backup drain with the power switch off measured about 75 microamps on my radio. If we assume an average typical operating time of one hour per day (to and from work, for example), then the battery will be charged for one hour and discharged for 23 hours out of each day.

A typical nicad battery is only about sixty percent efficient when charging, so the total charge per day will be $3600 \times 0.6 \times 1 = 2160$, or about 2 milliamp/hours per day. The battery will discharge for 23 hours at about 75 microamps, thus the discharge will be $75 \times 23 = 1725$ or about 1.8 milliamp/hours per day. Thus our battery should stay charged if the radio is used an average of 45 minutes for every 24 hours that it is off. These are worst-case figures, and in reality the battery probably needs only about 30 minutes of charge per day. Also note that as the battery becomes discharged, the charge rate will increase slightly due to the increased battery terminal voltage.

With a discharge rate of 75 microamps and a battery rating of 140 mAh, we can predict how long the battery pack will protect the memory without ever being recharged (if, for example, the radio goes unused for several days). Most cylindrical nicad packs exhibit an increase in their Ampere/hour capacity when discharged at a very low rate (we qualify). This increase is in the order of thirty percent. Thus, $140{,}000 \times 1.3 = 182{,}000$ effective μAh. Dividing this by 75 microamps and 24 hours, we can predict that this battery should keep the memory happy for more than three months.

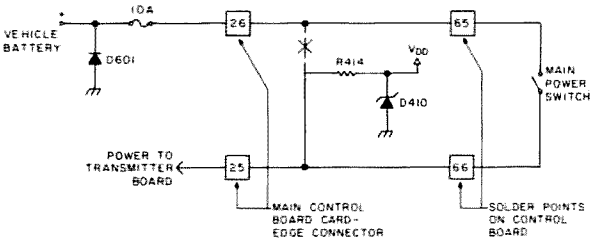


Fig. 3. Moving R414 to the cold side of the power switch eliminates current drain from the vehicle battery when powered off.

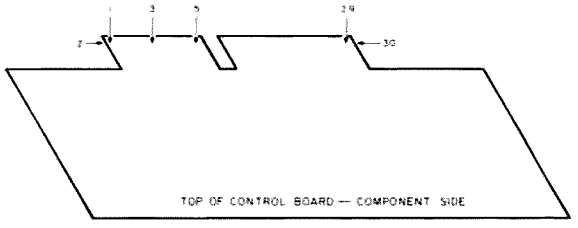


Fig. 4. Numbering sequence for control-board card-edge connector. Odd numbers are on top; even numbers are on the solder side.

The charge rate of 3.6 milliamps was chosen to be what is known as a minimum rate. This rate of charge is safe for continuous charging without harming the battery. If you wish to modify the charge rate, all that is necessary is to change the added resistor to a new value found by subtracting the battery float voltage from 5.9 volts and dividing the answer by the desired current. The 5.9 volts is the regulated Vdd found on the control board which we use to charge the battery. Be careful not to load this too heavily. A little experimenting will show quickly what is too much.

Reducing the Standby Current Drain

My Azden PCS-2000 came from the factory wired in such a way that it consumed 20 milliamperes from the primary power source even when the main power switch was off. The industry-accepted standard for mobile radios dictates a primary power connection directly to the vehicle battery. Under worst-case conditions—very cold weather, for example—it is possible that after an extended period of non-use this constant discharge could prevent a vehicle from starting. To eliminate this possibility, rewire the control processor board power as shown in Fig. 3.

This change is made very simply by moving one end of resistor R414 from main card-edge connector pin 26 to pin 25. Fig. 4 shows the proper numbering sequence of this connector. Trace pin 26 along the foil until you find R414. Lift this end of R414 from the board and tack it back down on a solder pad—about a quarter inch away—which comes from connector pin 25.

The result of this change is that standby current drain when the main power switch is off drops to an insignificant few tens of nanoamperes. This current comes from the reverse leakage in the power transistors in the rf PA module.

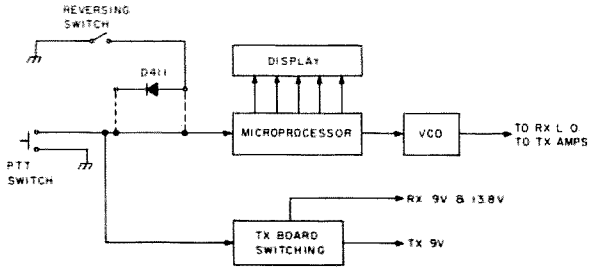


Fig. 5. Engaging the PTT switch causes the microprocessor to change the vco to the transmit frequency and causes the transmit switching to mute the receiver and turn on the transmitter. Adding diode D411 and the reversing switch allows the processor to be switched to the transmit frequency while staying in the receive mode.

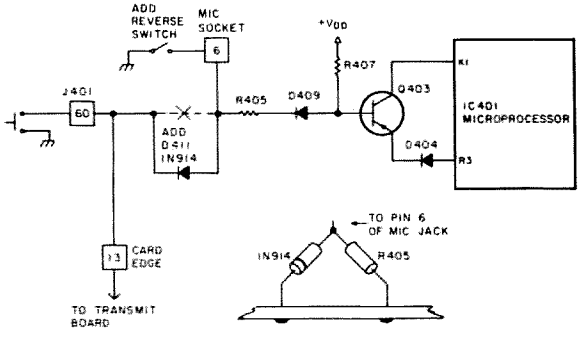


Fig. 6. Reversing switch is mounted in the microphone case. Lift one end of R405 and add D411 as shown.

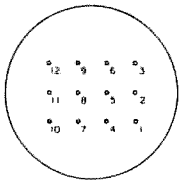


Fig. 7. Front view of the microphone jack showing the pin-numbering sequence.

Add a Reverse-Input Switch

Because of the way the microprocessor functions, it is very simple to fool the receiver into listening on the repeater's input instead of the output. Refer to Fig. 5. One of the things that happens when the microphone PTT switch is pressed is that the microprocessor reprograms the vco for transmitting on the offset frequency. This PTT signal also goes to the transmitter board to enable the transmitter and disable the receiver. The processor also changes the display to show the offset frequency. By telling the processor that we wish to transmit but at the same time witholding this information from the transmitter, the radio will receive on the transmit frequency!

With the addition of a single diode (shown in Fig. 6) and a slide switch in the microphone case, we have an instant reversing switch. I mounted my switch in the space vacated by the remote squelch control. The loss of this external squelch pot was not a problem since it was never used anyway.

Separate the microphone case by removing the four screws in the back piece. Remove the squelch knob and potentiometer from the microphone case. (For those of you who have purchased the old-style Azden DTMF tone microphone option, the knob will be missing already.) There are two red wires and one slate (gray) wire attached to the squelch pot. The reds are common (ground) and will be attached to one side of the new slide switch; the slate wire goes to the other side of the switch. The physical mounting of the switch is made simple by the use of quick-setting epoxy glue. Larger switches make necessary the removal of the mounting posts that held the squelch pot. Choose a switch whose slide arm doesn't stick through the case too far and whose action is stiff enough to preclude accidental operation when handling the microphone. Reassemble the microphone, being careful not to pinch any of the tiny wires.

At the control head, locate R405 (all the parts on this board are well labeled with white silkscreening). Find the end that connects to the cathode of D409. Unsolder *the other end* of R405 and lift it off the board. Insert the cathode end of a new diode, a 1N914, into the board where R405 was. Twist together the anode end of the new diode and the free end of R405. Connect to this junction a four-inch piece of insulated wire. Turn the control head onto its face and find the board holding all the potentiometers and switches.

Locate a large electrolytic and a 22-Ohm resistor. On the solder side of the board, about ¼ of an inch below the 22-Ohm resistor (towards the LEDs), there should be a pink wire coming from pin 6 of the microphone socket. Lift the board end of this wire and connect it to the four-inch length of wire coming from the new diode. Insulate the splice. See Fig. 7 for pin numbers of the microphone socket.

Refer to Fig. 6 for the following explanation. When the reverse switch is thrown, a ground is placed through the switch to the junction of the new diode (D411) and R405. This ground is reflected through R405 and D409 to the base of Q403 causing it to conduct, tying processor lines R3 and K1 together. This is the signal to the processor to change to the offset frequency. At the same time, the ground from the microphone is blocked by D411 from getting to the transmitter board. Thus the radio remains in the receive mode, but on the transmit (offset) frequency.

Note that this is a receiver-reversing, not a transmitter-reversing switch; if the PTT switch is pressed while in the reverse mode, the transmitter will come up at whichever frequency is stored as the offset. Saying it another way, the transmit frequency is not affected by either position of this new switch. Also note that the reversing switch relies upon the stored offset to function; if the radio is in the simplex mode, throwing the reverse switch will do absolutely nothing.

Scan Hang Time and Scan Sample Mode

The idea of scan hang time—the pausing of the scan for a few seconds before continuing after a channel becomes clear—is certainly not new. But it is indeed a most welcomed asset; without it, any pause in the carrier on a scanned channel will result in the loss of that channel until the scan comes around again. While driving through a marginal area, every time the receiver squelches due to flutter or "picket-fencing," the scan will resume and the channel will be momentarily lost. The addition of a few seconds of hang time will correct this aggravating situation.

Another mode of scanning is the sample mode. In this mode, scanning proceeds normally until an active channel is found; however, instead of staying locked to that channel until

it is cleared, the sample mode automatically forces a resume-scan trigger signal every few seconds. This allows a sampling of all active channels so that no one channel can lock out any other.

Under crowded band conditions this mode can become very confusing, but under the right conditions it can be very useful, giving a sort of priority channel function, ensuring that a certain channel will always be listened to at least once every few seconds. It seems that most hams have a favorite two or three repeaters they generally listen to, and if a "priority" repeater is programmed into every other memory location, then the listening duty cycle for that machine is very high and guaranteed by using the sample scan mode.

These last two additions are grouped together because the circuitry needed to implement them is centered around a single integrated circuit. Fig. 8 shows the circuitry involved with scanning. The important parts here are R406 and Q404. It is important to know that any time the SQ' line (control-board point 75) is pulled low, Q404 will conduct and scanning will stop. To resume scanning, all that is necessary is that the SQ' line be released to float high.

To begin a scan, something else happens, but once a scan is in progress, pulling line SQ' low will stop the scan and letting it go high will immediately start the scan again. This will continue until the scan is permanently stopped by pressing one of the stop keys or by keying the PTT button.

Another important bit of information we need to know is what happens to the line SQ SIG (control-board PC edge-connector pin 14) when a channel becomes active and inactive. This signal comes from the receiver board squelch circuits and goes high (positive) when a channel becomes active. Typical values are 7.5 volts high, 0.1 volts low.

Referring to Fig. 8, we will first examine the unmodified circuit. In the V or vacant mode, the receiver scans until it finds a vacant channel. A vacant channel will pull the SQ SIG low; this will be inverted to a high by Q401 and back to a low by Q402. This low will exit the control board via point 73, pass through the scan switch to the SQ' line, and stop the scan. In the B or busy mode, the receiver scans until it finds a busy channel. A busy channel will cause the SQ SIG line to go high. This is inverted to a low by Q401 and exits the board on point 74, passes through the scan switch to the SQ' line, and stops the scan. In either of these modes, as soon as the channel activity changes (for example, from active to squelched), the SQ SIG line toggles and the scan immediately resumes. In the F or free-scan mode, the scan switch simply opens the SQ' line and the receiver scans freely without ever stopping, regardless of channel activity.

It can now be seen that all that is needed to add some hang time to the B or busy mode is simply to add some delay to the SQ' line after the channel has squelched. If we add this delay in the form of an OR gate to the existing circuit, then the scan will be stopped by an active channel and held by the tail-end delay. The sample mode is much the same except that we remove the SQ SIG squelch input to the OR gate so that the only thing that stops the scan is a timer pulse triggered by the channel activity; when the timer runs out, the scan resumes.

Fig. 9 shows the added parts and how they interface with the existing circuitry. The V or vacant mode works the same as it always has. In the B or busy mode, diodes D412 and D413 make up an OR gate feeding the SQ' line through the scan switch. When a channel becomes busy, the SQ SIG line goes high and is inverted to a low by Q401. This low is fed through D412 to the SQ' line stopping the scan. As long as the channel is active, the scan will be stopped.

Now look at IC403-A and B; these gates, together with C411 and R418, form a pulse generator. The output pulse is a low-going pulse of about 2.5 seconds duration and is triggered by a low-going pulse at IC403 pin 2. While the channel is active, the high on SQ SIG is double-inverted by Q401 and Q402 and blocked by diode D414. When the channel clears, a

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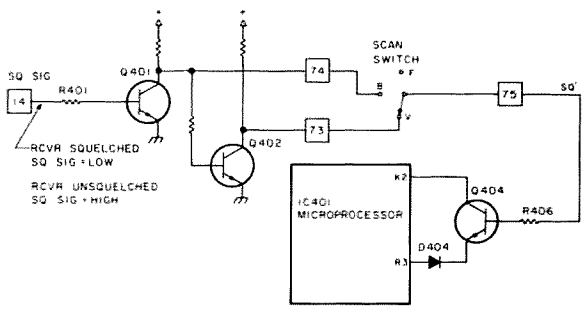


Fig. 8. Scan-control circuits before modification. Squelch activity enters board at pin 14 and arrives at scan-control switch Q404 either inverted or normal or not at all, depending upon the position of the scan switch. Scanning is stopped while Q404 is turned on; it resumes when turned off.

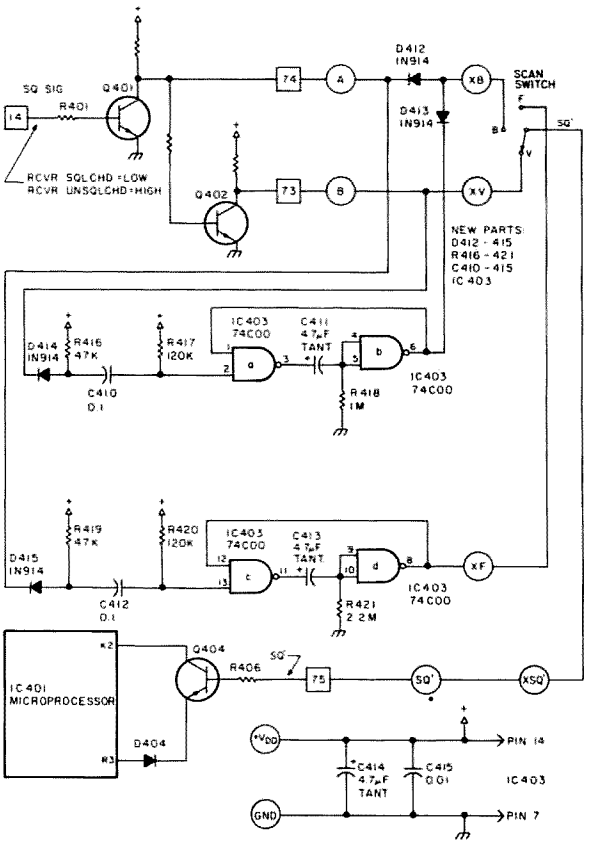


Fig. 9. Scan-control circuits after modification. Numbers in squares refer to existing control-board pin or pad numbers. Numbers in circles refer to inputs and outputs on the new board. IC403A and B and IC403C and D are wired as monostable multivibrators triggered by D414 and D415, respectively. Squelch activity enters through pin 14, upper left. Scanning is stopped while Q404 is turned on; it resumes when turned off, lower left.

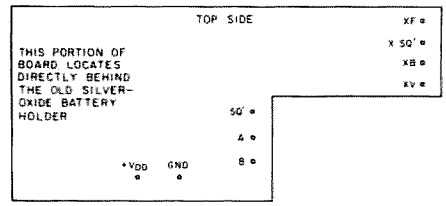


Fig. 10. Constructing the new scan-control circuits on a board this size and shape will allow them to fit neatly inside the control head between the control board and the potentiometer mounting board. The board is shown here as it would be viewed looking from the front of the Azden, down through the existing control board.

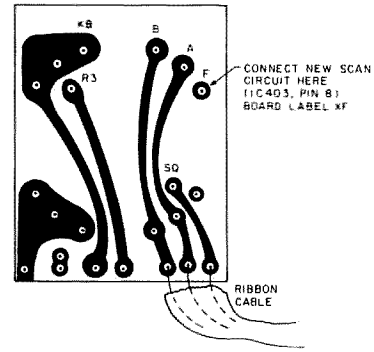


Fig. 11. Rear view of scan-mode switch showing point of connection from new scan circuit.

low is applied through D414 to the trigger-pulse generator made up of C410, R416, and R417. This trigger pulse is applied to pin 2 of the pulse generator, beginning a 2.5-second low pulse that keeps the scan stopped through D413. If the channel is still vacant when this pulse generator times out, the scan will begin again.

When the F or sample mode is chosen, an active channel again pulls the collector of Q401 low; this low is fed through diode D415 to the trigger-pulse generator composed of C412, R419, and R420. This triggers a 5-second low-going pulse which is fed through to the SQ' line and stops the scan. When this pulse times out, the scan begins again even though the channel is still busy. The reason for this is that the trigger-pulse generator, C412, has not reset and therefore cannot retrigger the holding pulse until the receiver restarts its scan.

With the parts values shown, the hang time is about 2.5 seconds and the sample time is about 5 seconds. These times can be altered by changing R418 (hang time) or R421 (sample time). Be sure to use tantalum capacitors for C411 and C413; other types may be too leaky to allow reliable operation. Do not substitute TTL NAND gates; the input impedance is substantially different and the timing will be completely wrong. Other CMOS NAND gates such as the CD4011 may be substituted, but be careful: The pinout will not necessarily be the same. The decoupling capacitors, C414 and C415, may not be necessary; they reflect my purist attitude in good circuit design.

The sample mode of scanning is implemented by using the old "free-scan" position of the scan switch. The output of the sample-mode pulse generator (IC403 pin 8) is fed to the unused switch terminal labeled F, as shown in Fig. 9.

Component layout is not particularly important for this circuit; the only real criterion is that the finished circuit fit within the confines of the control head. I used printed circuit techniques on an L-shaped board as shown in Fig. 10. This simple circuit can very easily be made by hand-painting the board using a small brush or resist pen. Vectorboard wiring is also a viable alternative. Even wire-wrap techniques could be used if the pins were limited to level-two height. After the circuit has been constructed, interconnect it to the control head as follows (see Fig. 10):

1) Connect a 3-inch twisted pair of wires to the new board at +Vdd and ground.

2) Connect a 3-inch twisted triplet of wires to the new board at SQ', A, and B.

3) Connect a 4-inch wire to the new board at XF.

4) Locate C403, a 470-μF electrolytic mounted on the foil side of the control board under the processor chip.

5) Solder leads +Vdd and ground across the leads of C403; observe polarity.

6) Locate the three-wire ribbon cable that comes from control-board points SQ', A, and B. Unsolder this cable from the control board and resolder it to the new board as follows: what was soldered to SQ', A, and B on the control board now connects to XSQ', XB, and XV on the new board, in that order.

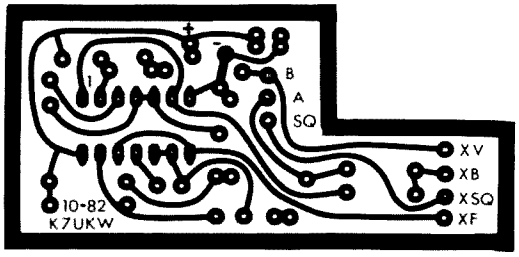


Fig. 12. PC board.

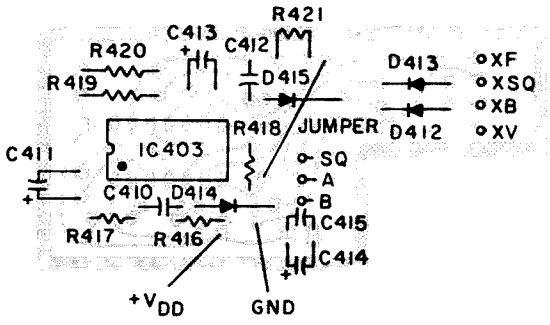


Fig. 13. Component layout.

7) Solder the triplet of wires to control board points SQ', A, and B from the identically-designated points on the new board.

8) Solder the wire coming from point XF on the new board to the unused point F on the scan-mode switch's printed circuit board, as shown in Fig. 11.

After all connections have been made, wrap the board completely with electrical tape or heavy kraft paper to eliminate any possibility of short circuits. Now gently guide the board into the space between the existing control board and the potentiometer mounting board, keeping it well to the left side, directly underneath the old silver-oxide battery holder. Fold the connecting wires neatly into place beside and underneath the new board. The stiffness of the connecting wires and the ribbon cable serve to hold it in place adequately; no special mounting is really necessary.

Now solder the nicad battery in place as discussed previously, making sure that it is wrapped sufficiently so that it will not become pierced when crammed into the confines of the control head. The battery fits vertically in the space directly behind the scan-mode rotary switch. Remember, the external speaker jack was removed to make room for this.

Before sliding the battery in place, try to smooth up the rear solder connections on the PC board for the scan switch by snipping the sharp lug ends flush, using semi-flush-type diagonal cutters, a sharp knife, or similar tool.

Caution— be very careful not to drop clippings, filings, or bits of solder into the control head; hold the unit upside down when smoothing up these connections!

Now slide the battery into the space provided and reassemble the control head. The top plate with the bit of foam rubber on the inside mounts so that the foam is pressing on the old battery holder. A piece of electrical tape over the battery leads on the old holder will eliminate any possibility of a short to the cover.

Testing Your Work

Plug the control head and the main chassis back together and hook up power and an antenna. Turn on the main power switch and write several of your local repeaters into the memory. If you don't have that many repeaters, write in anything; right now we just want to make sure the memory backup is working. Now turn off the power and go have a cup of coffee.

After five or ten minutes, turn on the power again. Check the memory; all should be as it was before the power was killed. Now move the scan switch to the right-hand V position. Press the MSCAN button on the front panel. The receiver should stop at the first vacant channel encountered and stay there until the channel becomes active. Now advance the scan switch to the B position. If the receiver is not scanning, press the MSCAN button again. The receiver should stop on the first busy channel and stay there until it clears. It should then remain there an additional 2.5 seconds (approximately) before scanning resumes. Now switch the scan mode to F. This is the sample-scan position. The receiver should scan for a busy channel as before; however, after it lands on an active channel, it will stay there for only about 5 seconds and then resume scan automatically.

Now place an offset into the memory—either plus or minus will do. Watch the display and throw the reverse switch on the microphone. The display should change to the offset and the receiver will follow the display.

If a sensitive current meter is available, the standby current drain can be measured; it should be less than one microampere with the power switch off and the power cable connected to a source of 12 volts. Typically, it will read less than 0.1 microampere.

Troubleshooting

No memory backup could be due to a discharged memory battery; a fully-charged battery will read about four volts with a typical VOM. Anything over three volts should still hold the memory. Recheck the battery polarity; the control board has a plus and minus silkscreened near the old holder.

Too much standby current drain could be due to several problems. The only reliable way of finding out which is to trace the wiring step by step and isolate each possible load until the bad one is found. Begin by verifying that every circuit except the rf PA board is connected to the cold side of the power switch. Next, disconnect the power from the rf PA board (pull plug P301). The PA is located on the bottom side of the main chassis at the rear and is connected to the hot side of the power switch.

If the reverse switch doesn't work, check that it really is switching a ground all the way back to the control board; check that the polarity and location of D411 are correct.

A problem with the scanning modification must be either in the new board or in the connections to it (assuming the scanning worked properly prior to the modification). The pulse generators can be checked with a VOM by watching their outputs and pulling the trigger inputs low; with a grounded clip lead, touch the anode side of the trigger diodes. Check the polarity of D412 and D413. Check the wiring between the boards and scan switch. Make sure the correct F point on the scan switch was used (there are two points labeled F on the scan-switch PC board; Fig. 11 shows the correct one).

These modifications should give you even more enjoyment from an already superb piece of communications equipment. ■

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VIC RAMification: Part III

Thank W6LOB for the memories.

In my previous article, "VIC RAMification: Part II," which appeared in the January, 1985, issue of *73* Magazine, I mentioned an alternate procedure for VIC-20s using 2K-by-8 RAM chips. Later versions of the VIC-20 have a greatly reduced chip count. Where there had been eleven 2114 1K-by-4 RAM chips, there now are only three. Two of the remaining 2114s are used for the lowest 1K block of RAM (including page zero) and the third is for color memory. The eight missing 2114s have been replaced by two 2K-by-8 chips. I used HM6116s in this second procedure. I believe that TMM2016s will do as well.

I would also like to apologize for an error I committed in the first article. Wherever I made reference to pins 4, 5, and 6 of the 74LS133, it should have been to pins 5, 6, and 7. This error occurs in Table 1, twice in step 5, and once in step 7 of the procedure section.

The theory of operation remains the same as specified in the earlier article. The list of materials and tools is changed only by the substitution of two HM6116-4s for the 2114s. The 6116s can also be obtained from JDR Microdevices, 1224 S. Bascom Avenue, San Jose CA 95128, for $4.75 each. The major change is to the procedure section. The newer VIC-20 has a much different parts layout and a much narrower board. Despite this, its basic functions remain unchanged.

Procedure

1) Open up the VIC. There are three Phillips screws under the front edge of the VIC. Remove these and gently lift the front. The case is hinged at the back. Unplug the keyboard cable and the power-indicator lamp cord.

2) Locate the 6116s. (See the previous article if your VIC uses 2114s.) The 6116s are directly in front of the 6522s and are designated U15 and U14. They are 24-pin chips, and regardless of the number on the top of them, they are equivalent to HM6116s. You may ignore the three 2114s which are directly to the right of the 6116s.

3) Locate the chip-select gate, the 74LS138, which is second from the left in the row of chips directly below the expansion connector. Its designation is UC4. It is used as an address decoder providing chip-select signals (low) for each 1024-byte piece in the first 8192-byte block, which we could call BLK0. We are interested in the select lines for RAM1, RAM2, and RAM3. These signals travel to the expansion connector and also to the data-bus control chip, the 74LS133, designated as UD9.

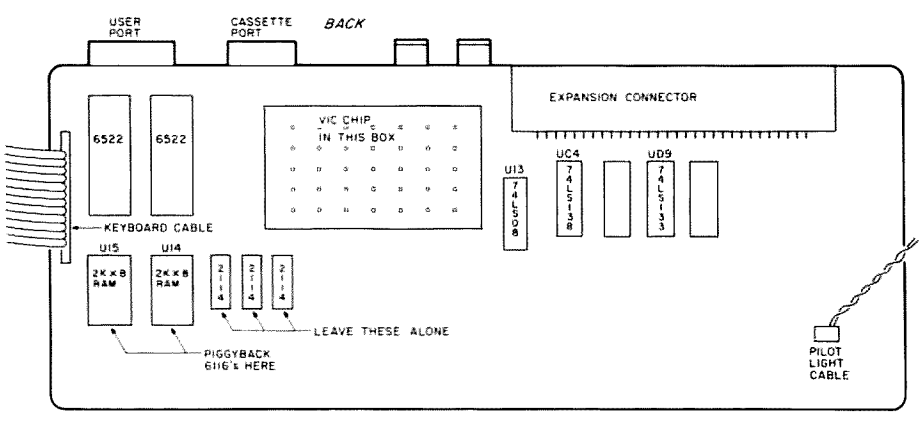


Fig. 1. Inside the VIC-20. Piggyback your new memory only where shown.

4) Locate data-bus controller UD9. This chip is located fourth from the left in the row below the expansion connector. Table 1 shows the connections of the chip-select signals. It would be wise to verify the specifications presented here with a VOM.

5) Cut traces. This step is taken to stop the VIC from shutting off the data-bus transceiver when RAM1, RAM2, or RAM3 are accessed. To cut the traces you must first remove the VIC board from the case bottom. It is attached to a metal carrier by three small machine screws and by solder tabs. Remove the metal carrier from the case bottom, and then remove the carrier from the VIC board by heating the solder tabs and prying them up.

Remove the three small machine screws, and the board is free. The traces to cut are at pins 2, 3, and 11 at UD9, at pins 12, 13, and 14 of UC4, and at pins 14, 15, and 16 at the expansion connector. Also cut the traces between pin 1 and pin 2 and between pin 2 and pin 7 of U13 (74LS08).

Use the X-acto® knife for this task. *Here are two warnings!* First: When you turned the board over, the relative position of the pins changed. What was once on the left is now on the right. Be extra careful that you are cutting the correct traces. Second: Make two cuts very close together and pry out the tiny chunk of copper, and don't let it get under any of the chips. Wet the end of

	(UC4) 74LS138	(UD9) 74LS133	Expansion Connector
RAM1	pin 14	pin 11	pin 14
RAM2	pin 13	pin 3	pin 15
RAM3	pin 12	pin 2	pin 16

Table 1.

your little finger and remove the scrap from the board.

Now, using a short piece of stripped wire-wrap wire, connect 74LS133 pins 2, 3, and 11 to 74LS133 pin 16. This will ensure that these three inputs will stay high, being tied to plus five volts. Connect pin 12 of UC4 (74LS138) to pin 1 of U13 (74LS08). Connect pin 13 of UC4 (74LS138) to pin 1 of U13 (74LS08). Verify these new connections (and disconnections) with the VOM.

6) Install 6116s. This step takes the most time. We are going to piggyback two new 6116 RAM chips on top of the on-board 2K-by-8 RAM chips. Make sure that all the pins on the new 6116s are parallel. Test-fit them on the on-board RAMs. The new chips should fit snugly without forcing.

Locate the chip select (pin 18) and the output enable (pin 20) on each of the new 6116s and bend them outward until they are ninety degrees to the other pins. Put each chip into the third-hand vise and lightly tin the inside of each of the pins. Place the two new 6116s piggyback on the on-board RAM chips.

Leave some breathing room between the on-board chip and its piggyback partner. Be sure you have oriented the new chips correctly. Pin 1 on these chips generally is indicated by a notch on one end. Pin 1 should be at the upper left-hand corner.

Tack-solder each chip to pins 1, 13, 12, and 24. These are the pins on each of the corners. After each chip has been tacked on, briefly touch each pin's junction with the soldering iron for all the rest of the pins. Check continuity of pin 1 of the new chip to pin 1 of an on-board chip without a piggyback partner. Do this for each pin with the exception of pins 18 and 20.

Note any pins showing an open circuit. Use the tip of the X-acto knife to gently push and hold the pin while applying the soldering iron. Retest the continuity with your VOM.

7) Prepare the chip-select lines which will connect each 6116 to the chip-select outputs. Connect pins 18 and 20 of one 6116 to pin 14 of UC4. These connections are made on the top of the board.

Connect pins 18 and 20 of the other 6116 to pin 3 of U13 (74LS08). Pin 14 of UD4 is the RAM1 select signal. We are using only half of the 6116 connected to RAM1. RAM2 and RAM3 are ORed by the 74LS08 to develop the chip select for the other 6116.

How can an AND gate perform an OR logic function? There is a theorem which states: A positive-logic AND is a negative-logic OR. Pin 3 will be high when RAM2 and RAM3 are high; that is, neither is active. Pin 3 will be low, selecting the 6116, if either RAM2 or RAM3 is low.

Check the continuity of these connections with the VOM. Now make a *non-continuity* check to ensure that the RAM1, RAM2, and RAM3 select lines are NOT connected to pins 11, 3, and 2, respectively, of the 74LS133.

8) This completes the hardware modifications. Before you put your VIC-20 back together and plug it in, here are some items you should check very carefully.

- First, are there any loose chunks of solder or bare wire lying around on the board?
- Second, are there any solder bridges between pins on the piggybacked RAM chips?

The third point may sound silly. It isn't. In the modification described in my previous article, I installed one of my 2114s backward. I found out during testing.

- Be sure your 6116s are all pointing north, as it were.

After your work passes this visual inspection, reinstall the board in the case bottom.

9) Button up the VIC. Screw the board to the shield carrier and bend the tabs over. After testing is complete, resolder the tabs to the board. Attach the carrier shield with the circuit board to the case bottom. Do not get the screws for mounting the board mixed up with those for fastening the case bottom to the case top (keyboard).

Hinge in the case top; connect the keyboard plug on the left and the power-on light plug on the right. For initial testing, you may want to leave the case top free or even off to the side a little. For final assembly, fasten the case top to the bottom with the three long screws.

RAMTEST program listing

```
10 PRINT"RAM TEST"
12 A = 1024:B = 4095
14 FORI = ATOB
16 PV = 85:GOSUB24
18 PV = 170:GOSUB24
20 NEXT
22 PRINT"TEST COMPLETE":END
24 POKEI,PV
26 IF PEEK(I) = PV THEN RETURN
28 PRINT"ERROR AT ADDR.";I
30 PRINT"DATA IS";PEEK(I)
32 PRINT"SHOULD BE";PV
34 RETURN
```

SCRMOV program listing

```
10 POKE 36869,144
12 POKE 648,4
14 FOR J = 217 TO 228:POKE J,132:NEXT
16 FOR J = 229 TO 250:POKE J,133:NEXT
18 POKE43,0:POKE44,6:POKE1535,0
20 CLR:NEW
```

Alternate load address procedure (direct mode):
POKE43,1:POKE44,16:POKE4096,0:CLR

Program listings.

Testing

Please refer to my January, 1985, article in *73* for the sections on testing and moving the screen. Basically, when you power up your VIC-20 after this modification, you should receive the message "6655 BYTES FREE." I had neglected to cut the trace connecting pin 14 of UC4 to pin 11 of UD9, thereby depriving myself of 1024 bytes of added memory. A couple of swipes with the trusty X-acto and all was well. ■

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John T. Cocking, "VIC RAMification: Part II," *73*, January, 1985, pp.22-24.

Yesterday's Circuits Today

Remember tubes? W6HDM does. He's resurrected a half dozen of his favorite circuits and updated them with semiconductors.

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Menlo Park CA 94025

Various circuits and techniques have had their day in the sun, only to be relegated into near oblivion by advancing technology, changing economic priorities, or by being somewhat less than practical; this has been true especially during times when the supporting technology was not that great. In electronics, as in other endeavors, the quest for better performance, higher efficiency, and reduced cost has evoked interesting schemes for squeezing more blood from the turnip. (Indeed, some innovators must have originally had perpetual-motion precepts on the mind.) It should, in any event, prove rewarding to review a few of these ideas and implementations. It is just possible that with modern devices and components, new life may be infused into an obsolete technique. Also, as is often the case, one thing leads to another and new concepts evolve from previous methods of problem solving.

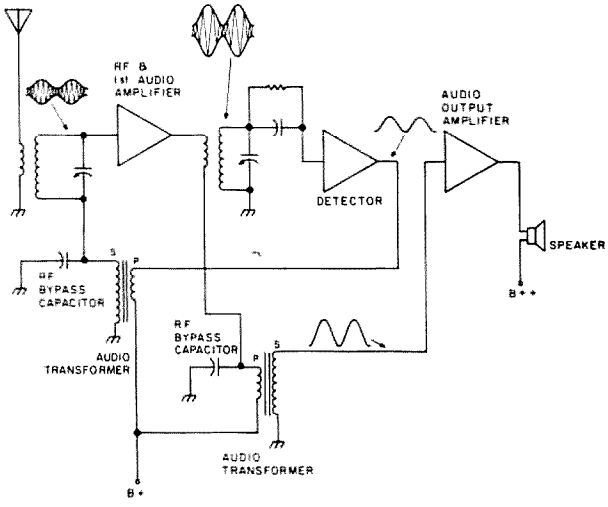


Fig. 1. Basic functional diagram of the reflex receiver. Although the stages were originally configured around tubes, it should be feasible to use solid-state devices such as transistors, FETs, or ICs.

The Reflex Receiver

A noteworthy example of yesteryear's pursuit of something for nothing was the reflex radio receiver. In its original and most prevalent form, a tuned rf receiver was so configured that an rf amplifier stage—usually the first—also served as the first audio-frequency stage. At first thought, such a concoction appears totally asinine. Common sense tells us that such a set would necessarily be plagued with all kinds of feedback problems and instabilities. Actually, how-

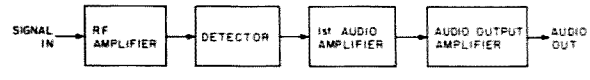


Fig. 2. Block diagram of equivalent receiver to the setup shown in Fig. 1. This is a conventional (unreflexed) system utilizing four amplifying devices instead of the three which sufficed for the reflex receiver. More complex reflexing arrangements can be used to eliminate additional stages.

ever, reflex radios were "hot" performers and there was generally nothing to distinguish their performance from more conventional circuits except that a three-tube reflex set would, indeed, exhibit four-tube capability. Even those reflex circuits which also included regeneration operated quite stably. Let us see why, our first intuitions notwithstanding, reflexing proved a feasible technique.

The schematic of a reflex set is shown in Fig. 1 and the block diagram of the equivalent receiver is shown in Fig. 2. It is easy enough to see that the rf stage also performs as an audio driver stage, but a little explaining is in order to illuminate how this is possible.

In order for an amplifier, be it tube, transistor, or IC, to process two different frequency bands without interaction between them, two requirements must be met. First, amplification must be *linear* so that no "mixing" or heterodyning occurs. This is readily complied with by ascertaining that the amplifier always operates in its class-A mode. Second, the frequency bands should be sufficiently different so that the outputs of the reflexed amplifier can be channelized easily to where they are supposed to go, and so that it is easy to get rid of frequencies that try to go into wrong places. This is accomplished easily in broadcast-band reflex radios because of the great difference between broadcast carrier frequencies and audio frequencies. Resonant tank circuits eliminate audio frequencies, and simple bypassing to ground eliminates straying radio frequencies.

The Regenerative Modulator

The regenerative modulator is a novel and unique circuit. Its mystique is enhanced by its very name—it is not a modulator with positive feedback unless you are prepared to stretch words a bit. A better name would be stimulated oscillator, or subharmonic generator, for that is what actually takes place: An input signal provokes an output at an integral submultiple of the input frequency. Granted, this is commonly accomplished with cascaded flip-flops. For example, a digital watch contains such a frequency divider for reducing the nominally-32-kHz crystal-oscillator frequency to one Hertz. And, of course, similar digital-divider systems are used in frequency counters, phase-locked loops, digital multimeters, and elsewhere.

The regenerative modulator is different in an interesting way. It is an "analog" circuit that operates from and produces a sine wave! It is capable of preserving either FM, SSB, or AM modulation. Regenerative modulators probably originated in the carrier-telephone industry, and it appears that the circuit was used more in England than in this country. At one time, hams used it and similar circuits to get crystal control on 160 meters (when only 80-meter crystals were available).

The basic principle of the regenerative modulator can be understood by referring to the block diagram in Fig. 3. It takes a little brain work to see what actually goes on. Once the theory of operation is mentally digested, you are certainly going to be heard exclaiming, "Now why didn't I dream that up?"

The circuit depends for its behavior on two nonlinear amplifiers and two bandpass filters. The first nonlinear amplifier is very similar to a mixer stage in a superhet: It samples two input frequencies and delivers a difference frequency. This difference frequency happens to be the *output frequency* of the circuit and is supported by the first bandpass filter or tank circuit.

The second nonlinear amplifier is very similar to the frequency multipliers commonly used in transmitters, although it usually is biased close to class-B rather than class-C operation. The harmonic output of this stage is supported by the bandpass filter or resonant tank in its output circuit. Finally, this harmonic frequency is *fed back* to the mixer stage. In order to visualize what happens, it should first be driven home that absolutely nothing transpires without input signal f_{IN}. Thus, despite the feedback loop and the apparent opportunity for interaction between the stages, the circuit remains inoperative with no input signal. Feedback notwithstanding, the tuned circuits are not appropriate for self-oscillation. Now, let's see what takes place when an input signal of the right frequency is applied to the regenerative modulator.

It is probably easiest to follow the operating sequence by referring to an actual circuit rather than to a block diagram. For this purpose, consider the tube version shown in Fig. 4. Inasmuch as original applications of regenerative modulators were implemented during the heyday of the

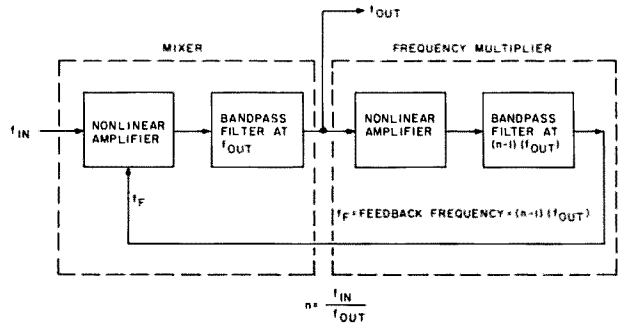


Fig. 3. Block diagram of the regenerative modulator. The amplifiers can be either tube or solid-state devices. The bandpass filters can be simple parallel-resonant circuits. The basic function of this arrangement is that of a frequency divider. Unless the proper frequency is applied to the input (f_{IN}), there is no output.

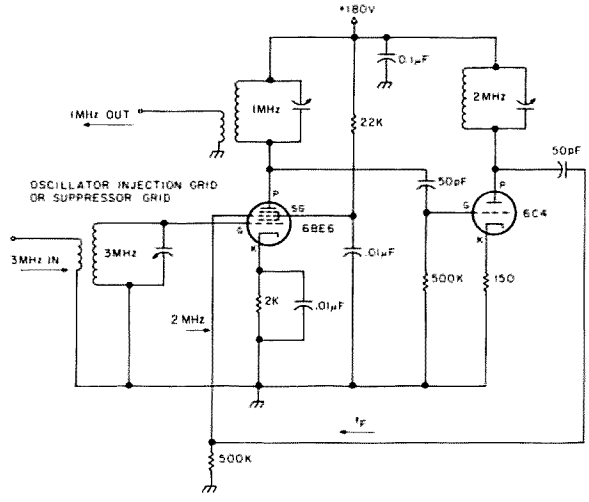


Fig. 4. An experimental tube version of a regenerative modulator. Strong drive is needed so that the tubes are operated in their nonlinear regions. The first tube can be any of a variety of multi-grid tubes such as converters, pentodes, etc.

vacuum tube, this tack has a natural relevancy. Once the tube circuitry is understood, no new concepts need be dealt with in grasping the performance of solid-state counterparts of the scheme.

With regard to the tubes used in Fig. 4, almost any other tubes can be made to work equally well. It is, however, particularly convenient to use one multi-grid tube, such as a converter or a pentode with external connection to the suppressor grid. The reason for this is that the first tube is required to output a difference frequency resulting from inputs impressed with *two* frequencies, the input frequency and a fed-back frequency.

Note in Fig. 4 that the input frequency is 3 MHz, which is applied to the control grid. Next, postponing explanation for the moment, it can be observed that the suppressor (or any other grid of a multi-grid tube) is impressed with a frequency of 2 MHz. That being the case, it follows that the 1-MHz tank circuit in the output of this stage serves to optimize the 1-MHz beat frequency produced by nonlinear interaction of the input frequencies within the tube. This, of course, is similar to the operation of mixers in superheterodyne receivers. In this particular application, however, we naturally ask what keeps the process going—in other words, why should the 2-MHz input obligingly appear?

The neat little trick that is used utilizes the second tube as a frequency multiplier. It is driven by the 1-MHz frequency we already *assumed* was generated by the first tube. The resonant tank in the output circuit of the frequency-multiplier tube supports the required 2-MHz feedback frequency.

But that is where we came in! Admittedly, a little trickery was indulged in this explanation because it was assumed that the circuit was *already* performing and then we proceeded to show *why* this could, indeed, be. It's simple enough, but experimentation with drive levels and biasing are in order for best results. Also, it should be appreciated that one cannot just throw in any old resonant circuits or apply any arbitrary input-signal frequency. These all have to be related according to the equations depicted in the block diagram. Once this relationship is obeyed, numerous frequency ranges and division ratios can be accommodated, however.

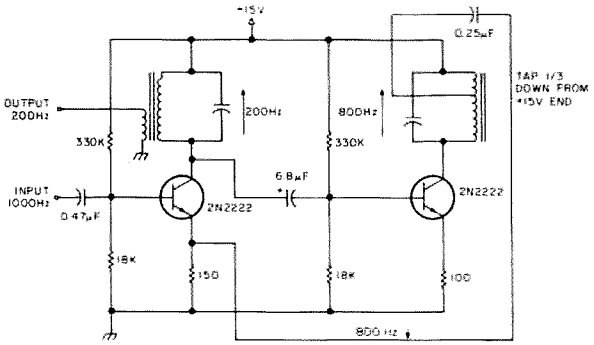


Fig. 5. An experimental transistor version of a regenerative modulator. Although this example circuit operates at low audio frequencies, the basic idea is applicable to radio frequencies as well.

The transistor version is shown in Fig. 5. In this instance, the regenerative modulator operates at audio frequencies. Essentially the same principles prevail as with the tube circuit.

The Synchronous Rectifier

Although the notion of synchronous rectification is as old as the hills, don't be too surprised to find its implementation in some of the most sophisticated modern power supplies. Its basic concept is simple enough—by applying the appropriate signal to the control element of an amplifying device such as a tube or transistor, you can make it conduct for the better part of just one polarity of an applied ac wave. In other words, you have accomplished rectification. It so happens that the enabling signal must be applied to the control element in *synchronism* with the wave you wish to rectify; therefrom stems the term "synchronous rectifier." The question before the house is *why* do it this way when we have no end of specialized diodes specifically designed for use as rectifiers?

The quick answer is that the synchronous rectifier is capable of developing appreciably less forward voltage drop than conventional silicon diodes when they were the last word in rectification efficiency. But the bottom line is that the synchronous rectifier can, in some cases, compete favorably with the modern Schottky diode in the matter of forward voltage drop. And, at least for low-frequency work, the synchronous rectifier tends to be more economical to use in production equipment.

In order to grasp the significance of the "resurrected" synchronous rectifier, it should be understood that, with bipolar transistors, its application is limited to low-voltage (say five volts), high-current power supplies. And it is frequency-limited to something in the mid-audio range, at best. No pretense is made that is usable for 20-kHz square waves. But for 60 Hz, its rectifying efficiency can be superb. It is feasible to rectify 25 or 50 Amperes and incur a forward voltage drop on the order of ¼ volt, or less.

Before we go any further, it must be explained that the synchronous rectifying element we have been talking about is none other than the germanium power transistor. If you thought this

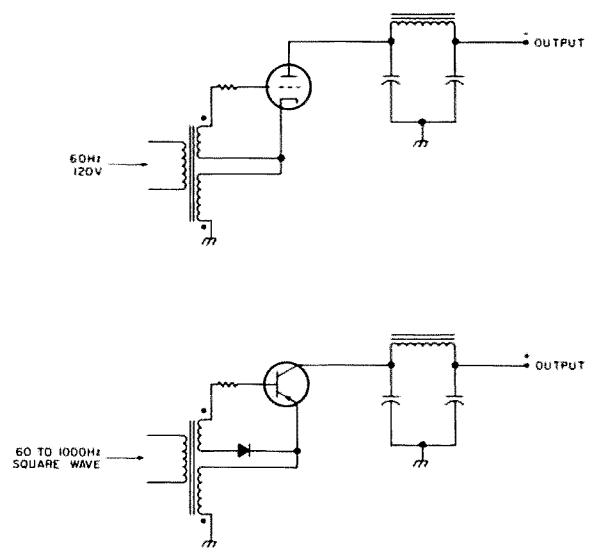


Fig. 6. Tube and transistor versions of the synchronous rectifier: Tube circuit (top) did not provide any noteworthy performance features; transistor version is capable of high-efficiency rectification for high currents and low voltages because internal voltage drop can be much less than for ordinary rectifier diodes.

device was extinct, think again—there remain several semiconductor manufacturers that still make germanium power transistors. And the *synchronous rectifier* is one of the applications they are pushing. This all comes about because $V_{CE\ (sat)}$ for these devices is only about 0.2 volts. Note that this is much less than the 0.65 volts or so for the silicon rectifying diode. For high currents, it is also less than the voltage drop produced by germanium rectifying diodes. If you are rectifying five volts at several tens of Amperes, a few tenths of a volt can be very significant in terms of dissipation and efficiency.

The synchronous rectifier has had its ups and downs. In its tube version, it never really had much to offer—there was no particular advantage in most cases in using it in lieu of conventional rectifier circuits. And in solid-state practice there have been myriads of dedicated junction rectifier diodes available for service in simple rectifier circuits. Nonetheless, we find that power-supply engineers have found a new virtue in this old technique.

Roughly analogous tube and transistor versions of half-wave synchronous rectifiers are shown in Fig. 6. The tube version is duck soup to implement because nothing bad happens when the plate polarity reverses. In the transistor version, precautions have to be taken to prevent reverse load current from finding a conductive path back to the emitter. Otherwise, the fact that the output polarities of the rectified current are different in the two circuits is not significant—it comes about because the tube is an NPN device and the power transistor shown is PNP.

Semiconductor firms are now developing special power-MOSFET devices for synchronous-rectifier service at higher voltages and higher frequencies.

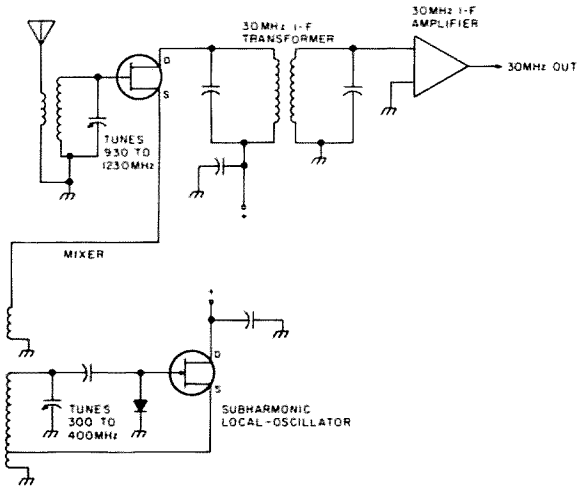


Fig. 7. Simplified circuit of the "business end" of a superhet, with subharmonic oscillator. Contrary to common assumption, the oscillator does not *provide harmonics of its fundamental frequency. Rather, the needed frequency multiplication takes place in the mixer.*

The Subharmonic Local Oscillator

An interesting circuit technique that has been in and out of fashion over the years is the submultiple or subharmonic local oscillator in a superheterodyne receiver. Basically, the scheme consists of using an oscillator with some fraction of the needed frequency in order to convert the incoming signal to the proper i-f band. This being the case, it often has been erroneously supposed that this is feasible by virtue of the harmonics generated by the oscillator. To see that this is not the *modus operandi*, one must appreciate the reason such an arrangement is used in the first place.

In UHF and microwave applications, it is not always easy to obtain the desired frequency stability from the local oscillator. If, however, the oscillator could operate at one-half or, say, one-third of the needed frequency, the stability problem tends to be greatly alleviated. However, it is also true that really stable oscillators produce nearly pure waveforms, i.e., sine waves without much harmonic energy. So for this reason the commonly assumed "harmonic output" from such oscillators is incorrect. But without harmonic generation, how can such an oscillator perform its intended frequency-translation function in the mixer stage of the receiver?

Here we must delve a bit into the mathematics of heterodyning. It turns out that with a certain proviso, an appropriate mixer or converter stage can produce beat frequencies according to the relationship: $f = w \pm nq$, where w is the incoming signal frequency (from the antenna), q is the local-oscillator frequency, and n is any whole number. This being the case it is a straightforward matter for selecting the desired i-f via resonance in the i-f transformer windings.

The proviso for this scheme to work is that the mixer or converter must have a transfer characteristic described by an exponent greater than 2. When this stipulation is met, that is, when the mixer is sufficiently nonlinear, the needed harmonics are generated *in the mixer*. Accordingly, a harmonic-rich oscillator is *not* needed.

The overall result is similar to what one might obtain from an oscillator with harmonics, but the design of the oscillator is facilitated because pure-wave oscillators tend to be more stable than those producing harmonic-rich waveforms. (Also, this technique circumvents troubles with "birdies" and spurious responses which would result from an oscillator rich in harmonics.)

Fig. 7 shows the simplified circuit of a superhet-receiver front end in which the local oscillator covers a frequency range which is only one-third as high as would be needed in the "conventional" approach. Despite the fact that the oscillator frequency is this low, the same range of signal frequencies is responded to as when conventional oscillator frequencies are used. It is as if a frequency multiplier (a tripler, in this case) were inserted between the oscillator and mixer. Indeed, such a frequency multiplier would accomplish about the same objective—permitting higher oscillator stability to be attained because of lower oscillator frequency. As pointed out, however, both frequency multiplying and heterodyning are readily accomplished within a sufficiently nonlinear mixer stage.

The FET mixer of Fig. 7 is only marginally nonlinear enough for the purpose and does not produce high conversion gain. A bipolar transistor would be better in this respect, but the FET circuit tends to be superior in signal-to-noise ratio. In either case, oscillator drive is critical for optimum performance because the requirements for harmonic generation and heterodyning are not quite the same. Although this circuit fell out of favor with the advent of high-frequency transistors, there has been renewed interest as experimentation is carried out for satellite communications equipment. Additionally, the technique is not uncommon in millimeter radar and communications technology.

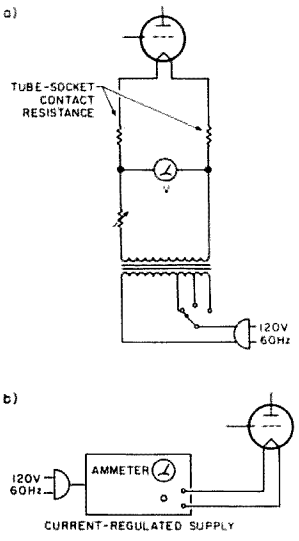


Fig. 8. Traditional and proposed methods of lighting up your transmitting-tube filaments: (a) the "good old way" and manually-adjusted voltage across tube socket may not have been so good after all; (b) proposed technique.

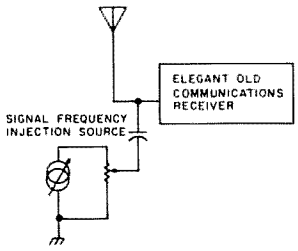


Fig. 9. Signal-frequency injection technique for SSB reception using an older receiver. The signal-frequency source is adjustable in frequency and in amplitude.

Transmitter-Tube Filaments and a Better Way to Fly

For many years the ham has been admonished by tube makers to maintain the filament *voltage* of his transmitting tubes within a prescribed range. For optimum performance and life span, this range is often cited as plus or minus five percent. This hasn't always been readily feasible for a number of reasons. The variations due to swings in the utility voltage and those accompanying key-up and key-down operation can easily fall outside of this narrow tolerance. And it goes without saying that the accuracy and readability of analog voltmeters have often contributed to an illusion of adherence to specified operation. There are also a couple of other matters pertaining to constant-voltage operation of tube filaments that, in this author's opinion, have not been accorded deserving discussion in the past.

First, the technique of measuring filament voltage by connecting the voltmeter across the tube-socket terminals can be responsible for errors of several percent even if one uses a modern high-precision digital meter. This pitfall stems from the contact resistance between the socket and the tube pins. Under best conditions (a low-current filament, a new high-quality socket, and a clean, dry atmosphere) there will be a negligible difference between the measured voltage and the voltage actually applied to the filament. But under average to worst conditions (a high-current filament, a not-so-wonderful socket that has seen a bit of service, and a polluted and/or moist atmosphere) the voltage indicated by the meter will be more than that actually getting to the filament leadwires within the tube.

The very worst situation is usually with high-current, low-voltage filaments in high-power tubes, for then the voltage drop due to contact resistance tends to be an appreciable percentage of the intended or specified voltage. Contact resistance unfortunately varies with spot temperature, contact pressure, and with surface conditions of the contacting metals. Corrosion may or may not be obvious.

The second matter has to do with the *basic notion* of maintaining a near-constant filament voltage. In perusing older literature on tube operation, I found that it appears that the true objective is to maintain a prescribed near-constant *current* through the filament. After all, thermionic emission is dependent upon filament temperature, which is more directly a function of current than of voltage. This may seem like splitting hairs, but it will be shown that better operating conditions and, very possibly, better tube life can accrue from this nontraditional approach. Indeed, one of the rewarding things about reviewing older circuit techniques is the realization that they can be either resurrected or improved using modern technology and practices.

If you are willing to buy the current-dependent concept of filament operation, the next step should almost suggest itself—the use of a current-regulated dc supply. One answer to why such a technique did not gain footing with yesteryear's hams is that a high-current regulated-power supply suitable for powering tube filaments was not an easy thing to build in pre-solid-state days. Its initial cost as well as its bulk and low efficiency would certainly have proved discouraging. Today, it is a trivial matter to construct inexpensive and compact regulated supplies. One also has the choice of using the series-pass "linear" approach, or for greater efficiency, the switching technique. Moreover, it is just as easy to make a constant-current supply as it is to make the more conventional constant-voltage supply.

One reason for going to constant-current operation has already been cited—the basic dependency of electron emission on heat-producing current. Another reason is the beautiful situation whereby the filament is caused to operate at the same temperature *despite* variations in the socket-contact resistance. That is the nice thing about a current-regulated supply—even though the overall load resistance may vary, load current remains constant! Although a voltage-regulated supply would gain us freedom from the effects of ac line voltage variation, tube-socket resistance variations would still affect the *true* filament voltage and its resulting current!

Summarizing our revamp of the traditional method of

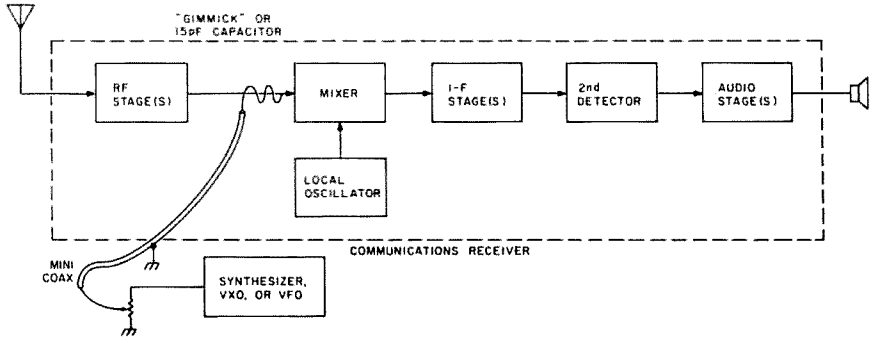


Fig. 10. A somewhat better arrangement for receiving SSB signals with an older set. In this setup, the signal-frequency injection takes place following one or more rf stages. Also, the use of a synthesizer is suggested.



powering transmitting-tube filaments, we have agreed (hopefully) to automatically regulate filament *current* and, although it has not been explicitly mentioned, we have agreed to the use of dc. Thus, a dc-current-regulated supply will be adjusted to provide a prescribed filament current and we will let filament voltage ("true" or otherwise) swing around to its heart's content. Fig. 8 compares the traditional and the proposed methods. In Fig. 8(b), tube-socket contact resistance is not shown because it is no longer a factor affecting thermionic emission.

A natural question with regard to this proposed practice is what do the tube manufacturers think about it? Not only have I been unable to extract strong opinions from them, but there has been little consistency in the meager information that has been forthcoming. For one thing, their feet are in concrete: You adjust for a voltage reading with a rheostat or autotransformer—that's simply the way it has always been done! I can't help wondering if it is subliminally suspected that the constant-current technique might lead to more widely-spaced tube replacements because of greater longevity! (Constant-current operation would do away with high-inrush current to cold filaments—a life-span-reducing phenomenon.)

Signal-Frequency Injection for SSB—An Update

An interesting circuitry technique stems from the 50s and 60s, when single-sideband communication was gaining a foothold in the ham bands. It was found that otherwise-superb receivers either could not respond to SSB signals or were very unstable when the i-f beat-frequency oscillator was used to demodulate that mode. Many hams found that a practical solution to this dilemma was signal-frequency injection. This technique simply made use of a stable oscillator to inject the missing carrier at the receiver's input along with the SSB signal itself. The scheme, in its simplest form, is depicted in Fig. 9.

An example of signal-frequency injection for the reception of SSB signals is a Hallicrafters model SX-25 receiver used in conjunction with a BC-221 signal generator, resulting in very satisfactory reception of 80-meter SSB stations. Initial tuning was done with the receiver. This served to locate the station; then the BC-221 signal generator was tuned to the missing carrier of the station, this being manifest by demodulation of the previously garbled audio which now became intelligible.

The significant aspect of this technique was that the SSB station remained intelligible for long periods of time—there was little tendency for it to slide into Donald Duck lingo. What this says, of course, is that the frequency stability of the BC-221 signal generator was exceedingly good—much better than the i-f bfo in the receiver. Interestingly, the BC-221 oscillator is self-excited. Think, then, how much better stability might be derived from a crystal oscillator.

We are rapidly homing in on an interesting design technique, resurrecting the use of signal-frequency injection. You can bet your boots that hams of that period also made use of the vxo for injecting the missing carrier of SSB signals. Of course, one of the shortcomings of the vxo is its inability to provide wide frequency coverage. This can be remedied via the use of multiple crystals and this, indeed, was also resorted to.

It so happens that many hams still have elegant old communications receivers that are capable of good SSB performance with signal-frequency injection. But today's ham has a new circuitry technique in his technical arsenal—the *frequency synthesizer*. I have not seen evidence of the use of the frequency synthesizer for such a purpose and would like to suggest it. It would appear that a very effective overall receiving system for SSB could now be implemented by the association of a frequency synthesizer with an older communications receiver. This would be yet another example where a nearly-forgotten circuit application could be profitably revived in today's ham shack.

The scheme depicted in Fig. 10 makes use of the suggested synthesizer and also incorporates a more desirable method of signal injection. Advantage is taken of the fact that many older communications receivers have one or more tuned rf stages ahead of the mixer or converter. By injecting the signal frequency at a point following one of these rf stages, radiation of interference is reduced to a negligible level. Note that the surgery required for the set remains minimal.

Of course, other refinements will suggest themselves such as optimization of time constants in the avc system and possibly the substitutions of a product detector for the one that sufficed for AM listening. But the bottom line of this discussion involves the suggested synthesizer, which either was not around or didn't fit ham budgets when signal injections were first experimented with. Although older receivers are often "boat anchors" with regard to size and weight, some are truly classic when one considers their performance. It would be a shame to relegate such a set to the scrap heap if a simple stratagem can be employed to remedy a shortcoming or two.■

Paul Clifford WA2AXO
18 Burton Lane
Massapequa NY 11758

Up, Down, and All Around

Fit your KDK 2016A with this ten-dollar Scan Can.

If you are the owner of a KDK 2016A, you know how frustrating it is to find those repeaters when you are on a trip. The *Repeater Directory* is of little help because I have found that a good number of the listed repeaters are no longer on the air. It takes a good amount of dexterity to manually switch through three thousand positions to find a repeater that is on the air—and even then you have no guarantee of finding one.

So why not end all that frustration and build one of these "Scan Cans"? The cost is low—less than ten dollars if you have a well-stocked junk box. The unique modular design lends itself to future expansion with other types of function modules. The circuit is simple and straightforward for ease of construction and troubleshooting.

Theory of Operation

See the schematic in Fig. 1. The clock circuit, U1, is an astable oscillator. Its frequency is determined by the combination of a 10k resistor, 100k variable resistor, and the 1-uF capacitor. The 100k variable resistor adjusts the frequency rate of the clock and the speed at which the Scan Can scans.

It is necessary to explain the terminology used for 8 volts and ground. A high (H) is +8 volts and a low (L) is ground.

The function of U2a pin 1 and U3c is to control the scan function. When U2a is high, the clock pulses on pin 2 are passed through to the input of U2c and inverted by U2c to the clock input of U4 pin 1. The function of U2c is to provide a two-phase clock for future development. When S1 is in position 1, the 100k resistor pulls U2a pin 1 to H and allows the unit to scan. When S1 is in position 3, at L, scanning stops.

In the same manner, the combination of U3c, U7b, and Q1 control the Receive Hold function of the Scan Can. Q1 serves as a buffer switch and interfaces with the receive LED of the KDK. A 2-volt potential on the base of Q1 forces the collector to go low. When U7b pins 5 and 6 are L, then pin 4 of U7b goes H. When U3b pin

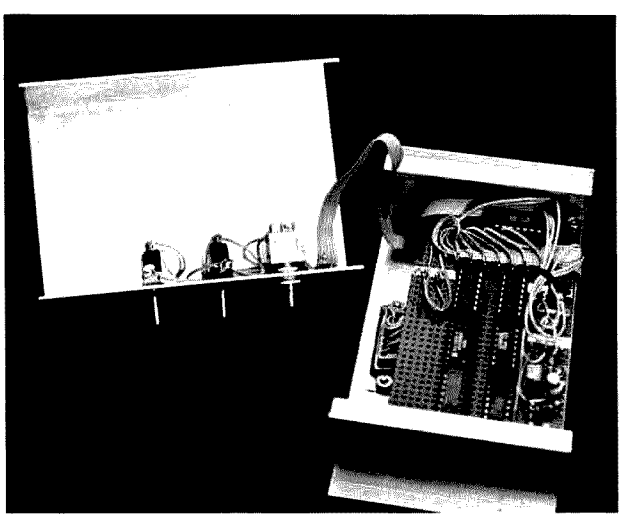


Photo A. The Scan Can showing the board layout.



Photo B. The Scan Can mounted in operating position on the KDK.

12 is H, then the counter U4 stops counting and holds. However, when zero volts is on the base of Q1, the counter resumes counting. When the scan function is in the Receive Hold condition and S2 pin 1 is placed to an L, the scan is resumed.

The BCD (Binary Coded Decimal) counter U4 has two separate 4-bit counters. One of the 4-bit counters (whose outputs are labeled A, B, C, and D) is the 10-kHz portion, and the other counter (with outputs labeled E, F, G, and H) is the 100-kHz portion. U3a and U3b are used as a decimal ten and a decimal one-thousand decoder, respectively. When both of the U3a's inputs are H, then pin 3 goes L, providing a clock pulse to the 100-kHz counter, and at the same time, U7a inverts the level and resets the 10-kHz counter to a count of zero. In the same manner, when both of the U3b's inputs are H, then pin 4 goes L and U2b pin 6 goes H, resetting the 100-kHz counter to a count of zero.

U5 and U6 are quad bilateral switches. They can best be described as eight independent single-pole single-throw (SPST) switches. When S3 is in position 3 and at H, then the switches are in the closed position, allowing the levels on the input pins to be present on the output pins labeled A^1 through H^1.

When S3 is in position 1, the outputs of U5 and U6 are switched open and the inputs will not appear on the outputs. This type of circuit is called tri-state logic. The three output-level states are high, low, and high Z.

Construction

The Scan Can shown in Photo A uses wire-wrap IC sockets and has flea clips as terminal pins. These parts are mounted on a perforated Vectorboard® that has the correct spacings for IC sockets. Other methods of interconnections may be employed because the layout of the circuit is not critical.

A 4¾"-wide by 3"-deep by 1¾"-high utility box was employed to keep the module as small as possible. D-type connectors are used because of their ruggedness and the fact that they can be used as surface-mount connectors. Five ¼" magnets are epoxied to the top of the unit to hold the Scan Can in place while connected to the KDK. This magnet attachment allows quick removal of the module when not in use or when another function module is to be used.

It is always a good idea to buzz out the wiring of the board before going any further in the construction. *Please note*: The CMOS chips used are diode-protected. However, static discharge will damage these ICs. It is recommended that you leave them wrapped in foil until you are ready to install them. After the board is completed, it is mounted in the chassis using ½" spacers. At this time the board is wired to the D connectors and the switches. I used flat ribbon cable to reduce the size of the wire bundle.

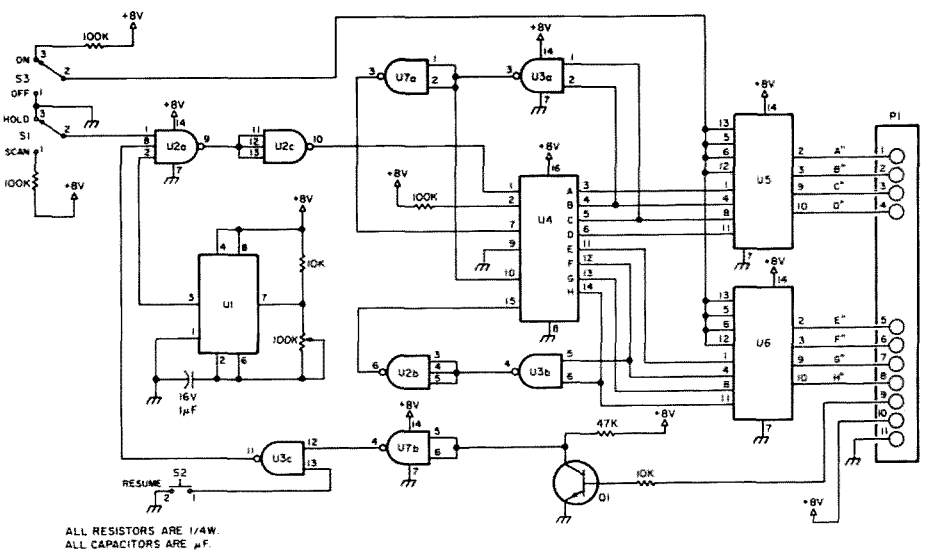


Fig. 1. Schematic of the Scan Can.

Interfacing to the KDK

Interfacing to the KDK is fairly simple and should not be too difficult for those who have worked inside the unit before. The steps taken to wire in the modification are as follows:

1) Remove both the top and bottom covers from the KDK.

2) Unsolder the speaker wires from the bottom cover.

3) With the female D connector as a guide, trace its outline on the front edge of the bottom cover. The connector should be centered ¼" from the edge. Drill holes and file to the shape of the connector. *Note:* leave the rubber pad in place and file through it.

4) Place the connector into the hole, center-punch connector mounting holes, and drill for #4 screws (a #33 drill).

5) Wire connector as per the schematic. *Note*: I used flat ribbon cable for this and the cable should be at least six inches long.

6) Mount the connector with #4-40 screws and feed the cable from the bottom close to the front panel through to the top.

7) Resolder the speaker leads and install the bottom cover.

8) Lift the synthesizer board. There are six screws holding this board down.

9) Locate IC-11 and IC-12 to determine the *location of* the proper pins that you will be soldering to (see Fig. 2).

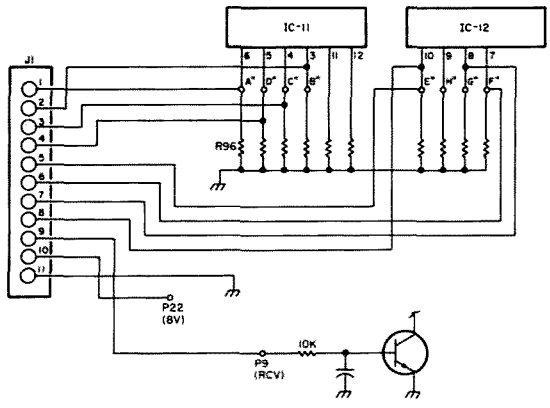


Fig. 2. The Scan-Can-to-KDK interface.



Photo C. View of the underside of the KDK. Note the positions of the connectors on the two units and the magnets.

The wires that go to these ICs are to be lap-soldered to the bottom of this board. Care should be taken that you do not overheat the pads when doing this operation. After you have lap-soldered these eight wires, inspect to see that there is no solder bridging of the adjacent pads.

10) Remount the board, being careful not to pinch the wires that you just connected.

11) Locate P9 (RCV), which is located at the rear of the board on the right-hand side. Snake the J1-9 wire through the harness to this location and solder to the pin.

12) Locate P22 (8 V), located at the lower left-hand corner of the top board. In the same manner as before, snake the J1-10 wire through the harness and solder to the pin.

13) The last wire to be connected is the ground wire. On the left-hand side of the chassis you will find a ground lug that has a capacitor connected to it. Snake the wire as before and solder it to this lug.

14) At this point in the interface wiring you should check that the wires are connected to the correct places, using an ohmmeter. After you have determined that the wiring is correct, remove the screws holding the bottom cover and install the top cover and button up. At this point you have finished the wiring required on the KDK.

Alignment

At this point you are ready to test the unit out. Care should be used when inserting the ICs. It is a good idea to ground yourself when inserting these CMOS chips. After you have inserted them and you are sure that the circuit is wired correctly, you are ready to test.

Connect the unit to the KDK and turn the KDK upside down. Have the cover removed from the module so that you can make some adjustments. On the KDK, set the memory switch to the off position. Set the main dial to zero zero zero on the LED readout. On the Scan Can, set the on-off switch to on and the hold-scan switch to scan. Turn on power to the KDK.

At this point you should see some activity on the KDK's LED readout. If you do not, turn off power and recheck your wiring. If you do have activity, adjust the 100k pot for a scan rate of approximately 100 kHz per second—or to a scan rate of your own liking. Observe that the 10 kHz is stepping from zero through nine and the 100-kHz position also is stepping from zero through nine. When these criteria are met, you are ready to go.

Tips for Operation

Operation of the Scan Can is fairly simple. However, there are tricks I have found that will help you when you operate the unit. I found that to stop on the correct channel every time I had to place the 10-kHz switch on the KDK to the 10s position. The scanner then stops on the right channel. Another thing to know is that your disc switch comes in handy when you are in doubt about the correct frequency. When you turn the on-off switch of the Scan Can to the off position, you can use the main dial as if the unit were disconnected from the KDK. When a signal locks the scanner on hold and you wish to operate on that frequency, set the hold-scan switch to hold. This allows you to transmit and receive on this channel. If you are locked to a frequency that is in use and you wish to resume scanning, press the resume button and the scanner will scan to the next frequency that is in use. ■

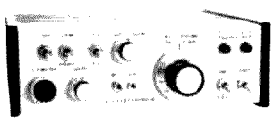
Parts List

U1	NE555	Timer
U4	CD4520	Dual binary up counter
U3, U7	CD4011	Quad 2-input NAND gate
U2	CD4023	Triple 3-input NAND gate
U5, U6	CD4016	Quad bilateral switch
Q1	2N2222	Transistor
P1	DA15P	D-type connector
J1	DA15S	D-type connector

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Build a Dynamic Duo

Add a speaker/mike and a 12-V adapter to your HT.

Dave Marling VE1VQ
Box 53A, RR1, Tusket
Yarmouth County, Nova Scotia
Canada B0W 3M0

My Yaesu FT-208R synthesized two-meter hand-held was purchased with the idea of making it something of a universal rig. While waiting for the mailman to arrive, I had visions of using it in the car to and from work, from hotels and rental cars on business trips, and even once in a while from my home.

Actual operation from a vehicle for an hour or so each day quickly indicated a couple of things that needed correcting to make mobile life easier; NiCd batteries don't last nearly as long as one might want, and RG-58 coax doesn't make the most flexible of microphone cords (especially on a cold winter morning!).

Speaker/Microphone

The external speaker/microphone (Photos A and B) was the first of the accessories to be built. I must admit to looking long and hard at the factory unit before seriously getting down to the task of construction. The deciding factor, however, was the offer of a free microphone connector by a fellow ham.

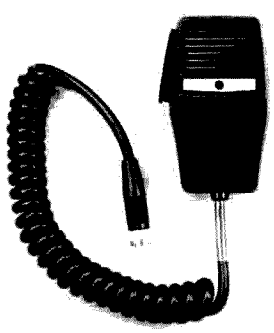


Photo A. Completed speaker/microphone. The mike cartridge is the dark circle in the white strip in the middle of the microphone.

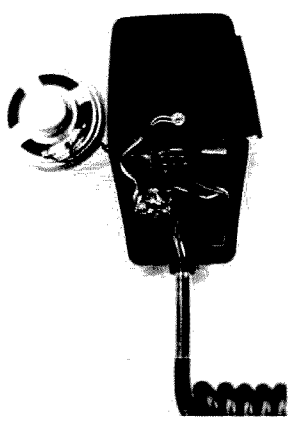


Photo B. Rear view of speaker/mike showing the microphone location. The grommet has been trimmed to allow the speaker to lie flat.

Digging through a box of discarded Citizens Band microphones produced an esthetically pleasing one with a defective cartridge. This same type of mike was used on the KDK FM-144-10SXR and quite a few 27-MHz rigs. A bit of measuring led me to the conclusion that a miniature speaker could, with some careful internal case trimming, produce a nice fit. The old cartridge was discarded and the case halves, screws, and coil cord were cleaned up with warm soapy water for a more presentable appearance.

The speaker was chosen to be close to the outside diameter of the plastic ring which held the original (discarded) cartridge (see Photo B). I used a Dremel-type hand tool with an edge-cutting disk to remove sufficient ring height to let the speaker fit with some looseness between the front and rear case pieces.

A hole of .203-inch (5.2-mm) diameter was drilled completely through the case front. Next, a drill of .234-inch diameter (5.9-mm) was used to partially enlarge the depth of the hole from the inside. Care should be taken not to let the bit pull itself all the way through. This enlarged hole was large enough to accept the new Yaesu mike element as a press fit.

If the drill wobbles and enlarges the hole, a drop of rubber cement, RTV, or other similar removable adhesive can be used to keep the mike in place. A small notch was cut in the case ring to allow the leads from the microphone to pass un-

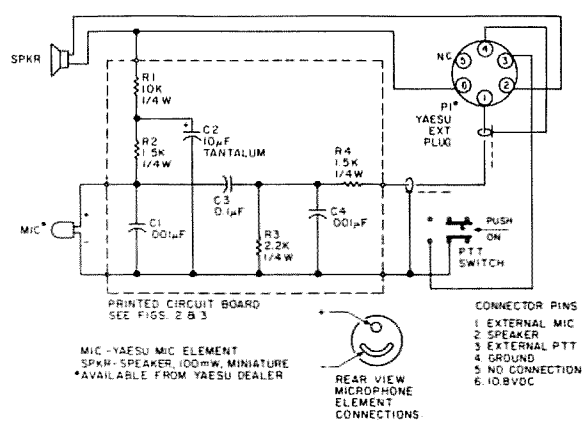


Fig. 1. Speaker/microphone.

der the speaker rim (via a small grommet).

The speaker leads were soldered to the correct coil-cord leads, and the junctions were covered with heat-shrink tubing. The leads from the mike cartridge as well as the necessary components were soldered directly to the copper areas on the small printed circuit board.

The board was cut and filed for a snug fit in the pocket provided in the front case half for the high/low power switch on the KDK. A scrap of carpet underlay glued to the rear case half keeps the speaker from rattling when the case halves are screwed together.

A small piece of aluminum strip with a .203-inch (5.2-mm) hole in the center is glued to the outside of the front, as shown in Photo A, to hide any drilling mistakes!

The parts are easily obtained. The speaker is a 1.75-inch (45-mm), 8-Ohm, 100-mW general replacement. The mike cartridge is a replacement element for the 207/208 series of hand-helds and is available along with the connector from your Yaesu dealer. Resistors are quarter-Watt, although eighth-Watt could be used. The capacitors (except for the 10 uF, which is tantalum because of the small size needed) are miniature ceramic.

Cigarette-Lighter Adapter

Now that I had an external microphone to make talking easier, I looked at the battery problem. Yaesu was kind enough to include the schematic of a solution in the FT-208R user's manual: a dc regulator circuit to power the unit from the cigarette-lighter receptacle.

My junk box didn't contain the same parts, so I made the necessary changes which are shown in Fig. 4. You will note that I left out the current-limiting resistor and plug that would allow me to charge the battery from the car, preferring instead a home-brew controlled-current charger kept in the shack.

A 15-volt, 1/2-Watt zener has been added to the input for two reasons. Any spikes over the zener voltage will be clipped before reaching the regulator section, and secondly, should the vehicle-battery voltage rise over the 15-volt point, the diode will short circuit and cause the fuse to blow, effectively letting you know that something is wrong and needs attention.

As can be seen from Photo C, the adapter circuit was built on a small piece of PC board 1.5 x 2 inches (38 x 51 mm). This board was mounted on standoffs (three 4-40 screws) in a plastic case that had previously housed a burnt-out ac-to-dc wall adapter.

No PC-board layout is given since the circuit is fairly easy to make by hand with a resist pen. Point-to-point wiring can be used just as well. The heat sink for the pass transistor (TIP42C) is made from a scrap of .062-inch (1.6-mm) aluminum.

Adjustment is simple. Insert the fused plug into a vehicle cigarette-lighter socket. With a VOM connected to monitor the voltage across the output plug, adjust the 1k-Ohm potentiometer for 10.8 volts.

My unit was tested for two hours on continuous one-Amp load. Output voltage dropped by less than 0.3 volts, and the heat sink was only comfortably warm to the touch.

Last Words

While the gadgets described were built for the Yaesu FT-208R, there is nothing to stop anyone from adapting them for many of the multitude of hand-helds out there in vacuum land. Changing the mike element, the connections, and the connector should suffice if your rig uses a similar electret cartridge. If yours takes a standard (non-electret) type, the PC board won't be necessary.

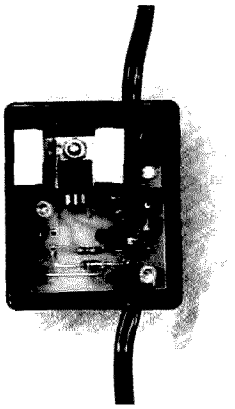


Photo C. Interior view of the dc regulator. The plastic case allowed me to use oversized heat sink for good heat dissipation.

As for the adapter, possibly only a simple adjustment of the potentiometer will be required. The adjustment range with the values shown is from 8.5 to 12.7 volts (with 13.8 volts input).

Synthesized two-meter hand-helds may not be the perfect rig—yet—but a few additional accessories can go a long way towards that goal. ■

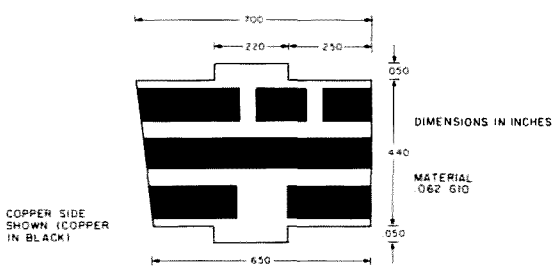


Fig. 2. PC board, external microphone.

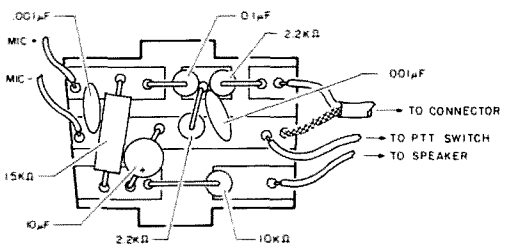


Fig. 3. Parts placement, external microphone.

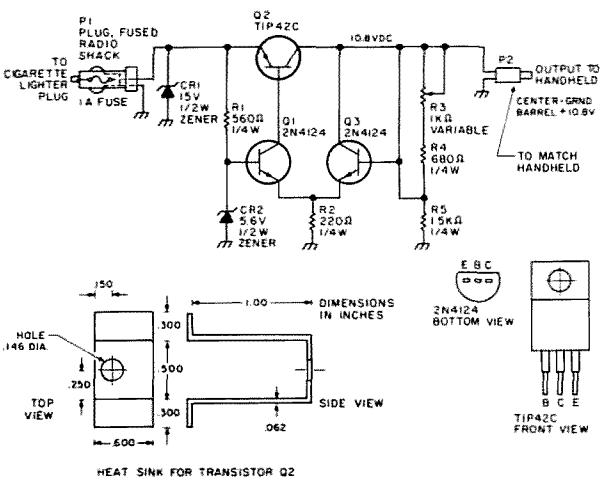


Fig. 4. Cigarette-lighter adapter.

Steve Wolf NO8M
27132 Butternut Ridge Road
North Olmsted OH 44070

Scanning the TR-2400

A simple mod for lazy hams—push the button and it scans!

My Kenwood TR-2400 handie-talkie has served me long and well. It is an especially nice companion at work, where I drive through the late-night hours. At these times the bands are inactive, and even scanning the ten memories I find my radio time quiet and disappointing. The TR-2400 can be scanned manually by keeping the scan-down button depressed. This can be tedious; it requires your constant attention. For this reason, I began looking longingly at the newer autoscan HTs.

The feature of band scanning would give me just what I wanted. The price of the new HT seemed reasonable, and my TR-2400 could be kept for my darling, almost-licensed wife. But stop and add up the total cost. The HT isn't what gets you—it's the price of the accessories. I might as well buy a full-size radio with all the other bells and whistles. The base charger, speaker mike, battery packs, etc., really boost the price!

I brought out the service manual, and after about a half-hour of tracing wires it appeared that by switching the scan button with a transistor, the TR-2400 could be scanned. All one would need for this project was a switching transistor (2N2222,

Photo by Joseph A. Cihy

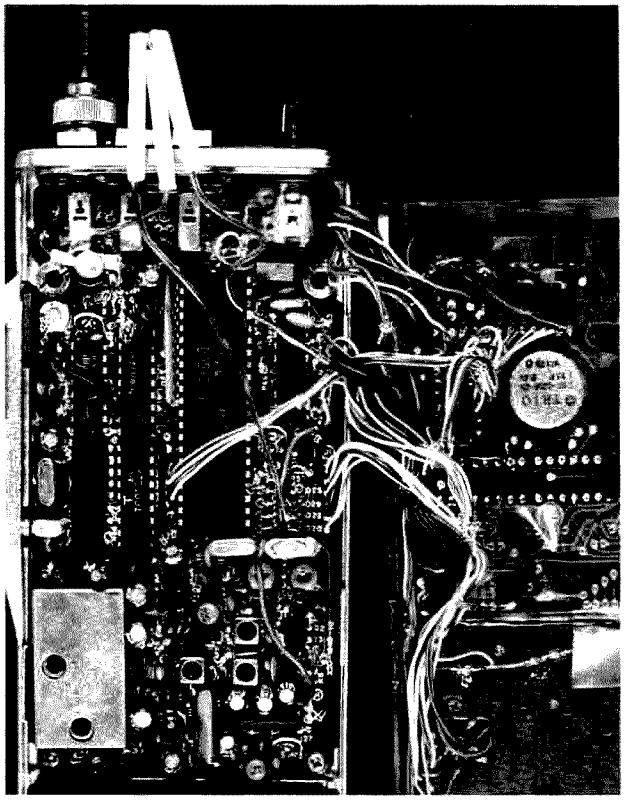


Photo A. Tape all of the leads to avoid a short circuit.

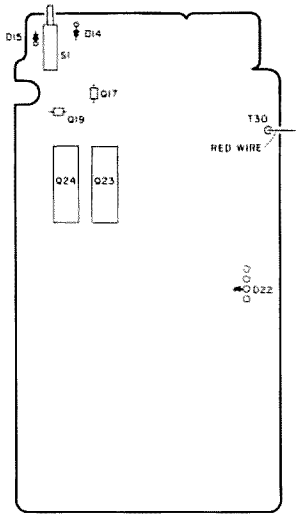


Fig. 1. The PLL board. S1 is the scan-busy switch which is to be modified. The bases of D14 and D15 must be hard-wired together. The collector of the scan transistor is spliced into the red wire at T30. The emitter is wired to the top of D22. The collector of Q17 is taken, through the switch and resistor, to the base of the scan transistor.

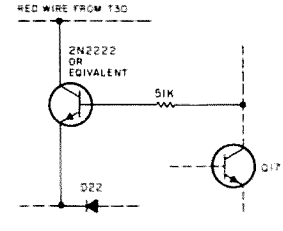


Fig. 2. The entire schematic.

or whatever), a resistor of about 50k, and some wire.

The preparation, however, is a little more complicated. If you have never worked on a synthesized, microprocessor-controlled HT before, read this carefully!

Preparation

1. The day you plan on working on the rig should be your day off.

2. The day before, do whatever it is you do to get all your frustrations out!

3. Reconcile all relations that were severed in the above step.

4. Get a good night's sleep. Don't start on the HT until after you have your coffee, read the paper, etc.

The Modification

This modification is for radios with serial numbers between 006XXXX and 010XXXX. I will describe the steps, and if you have another model you should be able to implement the change without too much trouble.

The front cover needs to be removed first. Remove the battery and take out the two screws in the battery compartment. Leave the two middle screws on the back cover in place. Take out the top two screws. The front cover can now be removed, *carefully*. There is a rat's nest of interconnecting wires, all of them easily broken. Pretend it's a bomb.

Remove the four screws holding the PLL board in place. Pull the board down toward the battery compartment. The board should now be free.

We are now going to work on the scan-down button. I chose this one (rather than the scan-up) because it is easily locatable. If your scanning radio locks on a channel you are not particularly fond of, you can reach over and touch the scan-down button again to bypass that channel. The radio will lower its frequency by 5 kHz each time. Once the squelch closes, the radio will begin scanning automatically.

The schematic showed that by connecting points Y4 and T30 I would have effectively pushed the scan-down button. Y4 can be picked up easily on top of diode D22. T30 is the connection point for the red wire, and I could not locate an easy way to pick up that point. Stripping some insulation back from the red wire provided that connection. Hard-wiring these wires gave me the scan-down for which I was looking.

Now I needed a scan voltage. I could say something brilliant about finding this, but to tell you the truth a VTVM and some poking around was all it took. Pin 36 on the microprocessor is the squelch-suppression input. This is controlled by Q17. The collector of that transistor gave me the low on signal, high on mute, that I needed.

The busy/open switch, a useless entity on my radio, was used to turn the scanner on and off. Take the switch off the board and bend the pins up. Attach two wires to the top two contacts. Remount the switch, being careful not to overheat the pads. Hard-wire the base of D14 to the base of D15 with a short piece of wire. This wire takes the place of the switch.

Take one of the wires from the switch and bend a very small hook in its end. With the radio off and the battery removed, hook this wire onto the collector pin of Q17. This is the *center* pin. Solder the wire very quickly with a low-wattage iron. Don't burn out the transistor.

Solder a piece of wire onto the red wire and another from the top of D22. Put a piece of heat-shrink tubing or spaghetti over these wires and hook them up to the transistor. The wire from the diode is attached to the collector and the wire from T30 is soldered to the emitter. Slide the spaghetti over the connections.

So far, so good. I had to experiment with the resistor in series with the base lead. I finally determined that 51k was the proper value and soldered one to the base lead. The second wire from the switch is then attached to the resistor. Wrap the transistor in tape and place it against Q23 and Q24. If you have been extremely careful, you're ready to button it up.

Very carefully see if you have broken any of the many interconnecting wires. If you have, I strongly suggest you take a nice long break. Have a cup of coffee, watch a program on TV, visit Hawaii. If any of the wires are broken, others will probably be in the way when you attempt to reattach the cover. Do your best.

Be especially careful about the power-supply wires and L101, the choke coming off the battery lead. It is very easy to smoke the radio by pinching one of these wires. I have done this twice now.

Operation

Operation of the scanner is easy. Push the button and it scans. It will stop on a channel if a signal is present. There is no delay; the radio will resume scanning when the signal is dropped.

I have found that the scanner will stop on the center frequency about ninety percent of the time. It rarely stops after the signal has been passed.

With a new Radio Shack transistor (276-2009) at 79 cents and a new 51k resistor at two for 19 cents, the total price comes to 98 cents. Charge yourself $30.00 per hour for labor (the going rate!). Now, take your profit and go out and buy that computer you have wanted. ■

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The RIT Stuff

Clarify your FT-101E's reception with this five-component modification.

The DX bulletin indicated that the newest DXpedition was expected on 20-meter CW about 1300Z. Since working their island would put me one step closer to DXCC, I made a mental note of the frequency and time. When the twenty-four-hour clock turned over to 1300Z, my FT-101E was set and ready to join the pileup. A little tuning found them at 14.028, but the hordes of calling stations were up around 14.035.

Well, a spread of 7 kHz fell smartly beyond the ±5 kHz of the RIT (clarifier) circuitry in my transceiver. After several earlier attempts to move the vfo back and forth to catch a station working split frequency, I had learned it was pretty frustrating. Foiled again! Of course, similar tales of woe can be told about working European stations on 40 SSB, especially during contests. The Europeans cannot use sideband above 7100 kHz, while the American phone subband starts 50 kHz higher. That's really stretching an RIT control.

After a few of these situations, it was clear that an external vfo could be very helpful for the kinds of operating that I was doing. Earlier, though, Yaesu had put the FT-101E model out of print, so to speak. This apparently was because of projected problems obtaining the sweep tubes to support their production and replacement requirements. So, I started checking out the used equipment

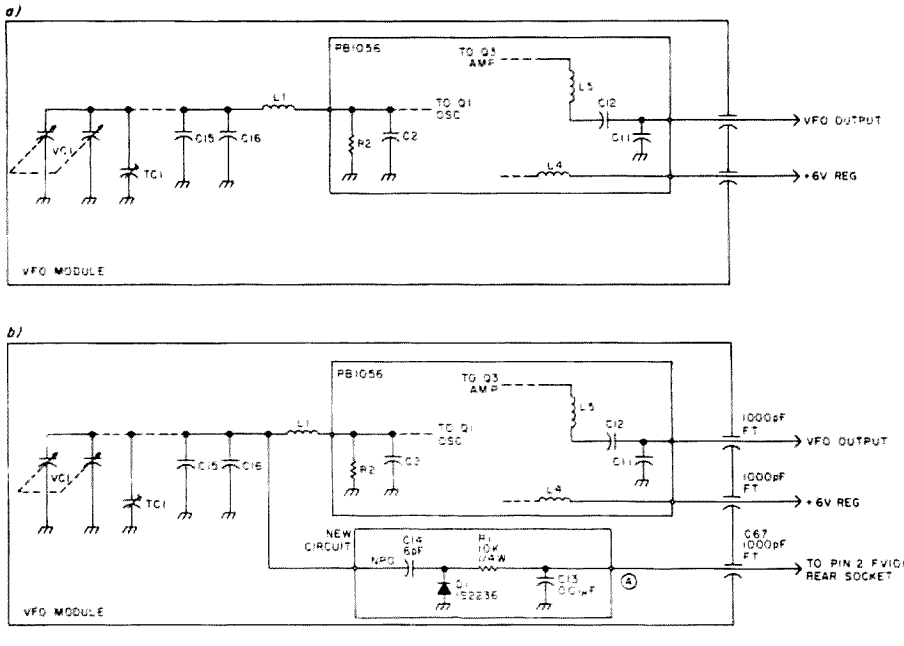


Fig. 1. Partial schematic drawings of FV-101 vfo before (a) and after (b) modification to include RIT circuitry. Components on the added board are indicated in (b).

market. I realized quickly that when an FV-101B external vfo did turn up, it inevitably was bought very quickly. In time, though, I managed to find an older version (FV-101) that was intended for the earlier FT-101s. The popularity of this accessory was indicated by the used price being above its original value.

After first checking the unit out, it appeared to work as it should. However, when I set the vfo selector switch to external transceive, I noticed that the RIT control on the FT-101's front panel didn't have any effect. Nor did the RIT circuitry work when the remote vfo was used to control only the receiving frequency. This seemed curious since it certainly is useful to have full RIT capability for both vfos.

Determined to correct the problem, I pulled out the two owner's manuals and studied the schematics for each vfo. This showed that nothing was wrong with my "previously-owned" FV-101. Yaesu simply had not put the RIT circuitry in it. If you examine Fig. 1, you will see that only five components need to be added to the FV-101. The remaining circuitry is contained within the transceiver. None of the components is difficult to get. For your reference, several suppliers are listed in the box. Undoubtedly, there are others as well. The total cost of the components should be around five dollars, assuming that your junk box is empty.

So this became the latest home-brew construction project for me. It seems that the way many of these work out is that what electrically looks like child's play often turns out to be rather involved mechanically. This principally is because the compactness of our modern rigs leaves little room for fingers and tools. Relax, though; much to Murphy's amazement, this modification is a breeze!

What is necessary, of course, is to add the varactor diode (D1) and its associated circuitry inside the remote vfo and connect it to the transceiver. The circuitry itself is not difficult to understand conceptually. A low dc voltage is applied at point A in Fig. 1 (b) by means of a connection to the RIT control on the FT-101E/EE/EX front panel. This voltage is applied to the varactor diode through a current-limiting resistor and this is varied by the setting of the RIT potentiometer on the transceiver's front panel.

A primary characteristic of varactor diodes is that the capacitance across the P-N depletion zone changes with the applied voltage. This capacitance is non-linear and is proportional to the square or cube root of the voltage. The actual capacitance range obtained in this manner is in the order of a few pF depending upon the diode's reverse breakdown voltage and its forward conduction. Those who want to experiment might try using a rectifier diode. If you are interested in reading further about these diodes, a more comprehensive discussion can be found in References 1 and 2. The varactor capacitance, acting together with temperature-compensated series capacitor C14, provides the incremental frequency change as the RIT pot is varied. A relay inside the transceiver is used to disable this circuitry during transmit.

The point that the RIT circuit functions at dc is important because this means that component placement, stray lead capacitance, etc., will not affect performance as they do in many rf circuits. The components that need to be added to the FV-101 (except for the feedthrough, C67) can be mounted on either perfboard or a small PC board. I prefer the latter since it generally allows a neater assembly and has another advantage that we'll get to in a minute.

Parts Suppliers

C13, R1—Radio Shack; Circuit Specialists, Box 3047, Scottsdale AZ 85257.
C67—Semiconductor Surplus, 2822 N. 32nd Street, Unit 1, Phoenix AZ 85018.
C14—Circuit Specialists.
D1—Electronic distributors, e.g., Hatry's, Ledyard Street, Hartford CT. RCA SK3126 & Workman WEP200 are equivalent to the 1S2236. Distributors will also carry many/all of the above components.

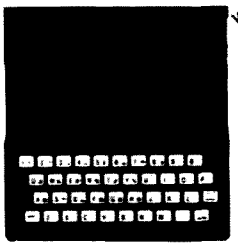
The RIT circuitry board is installed inside the vfo module. I found that mounting this board to the removable bottom cover of the vfo module was the most convenient. Access to this cover is gained by removing the cabinet and turning the unit upside down. I used a couple of machine screws and small (¼-inch) metal standoffs for the mounting hardware. The board was positioned near the rear of the cover plate (on the inside). At this point, the extra advantage of the PC board approach becomes apparent. This is simply that the ground connection between the vfo and RIT circuits is automatically established by the PC board's ground foil. Be sure to make this ground connection with a separate wire if you elect to use an unclad perfboard for your work.

A length of hookup wire connects from C14 on the board to the side of L1 that is connected to VC1, etc. Another wire is run from point A to a feedthrough capacitor mounted in the side of the vfo module adjacent to the two existing feedthroughs. In my FV-101, there already was a convenient hole at that point. You may find that it is easier and faster to use a screw-in feedthrough rather than the solder type. Finally, another length of hookup wire connects this new feedthrough to pin 2 on the FV-101 rear socket which was originally unused. This completes the FV-101 circuitry modification and all that was involved was a few components and some wire. Life would surely be easier if all equipment modifications were so straightforward.

The next step involves connecting the remote vfo to the RIT circuitry in the transceiver. Fortunately, this is equally simple. Remove the screw-on cover from both plugs on the remote vfo cable and install another piece of wire inside the cable jacket. This will be easy to do if you use a coathanger or such to pull the wire through the vinyl jacket. Then solder the new wire to pin 2 of each plug and put the plug covers back on. This provides a neat cable assembly without any loose wires cluttering your desktop.

Now remove the screws and two small nuts that attach the bottom cover to the transceiver. Solder a wire from pin 2 of the FT-101 external vfo socket to the RIT (clarifier) feedthrough capacitor located on the transceiver vfo module. Be careful, as there are three feedthroughs here. A VOM can be used to identify the correct one since it is the only feedthrough connected directly to the wiper arm (center contact) of the RIT potentiometer. The placement of this wire between the jack and vfo module is not critical.

Prior to putting the FV-101 back in its cabinet, it is necessary to take a moment to align its vfo to the main vfo in the FT-101. The extra added capacitance in the



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circuitry will change the FV-101 frequency somewhat and the actual frequency will not agree with the dial calibration markings. All that is required is a screwdriver adjustment. Initially, both vfos should be checked against the calibrator reference signal in the FT-101.

With the RIT switch off, inject a signal from an rf generator into the radio's antenna connector and zero beat it with the transceiver vfo. Note the frequency on the transceiver's dial and tune the external vfo to the same frequency. The vfo selector switch should be turned to either the External or RX Ext position so that the FV-101 is controlling the receive frequency. Now adjust TC1 with an alignment screwdriver to zero beat the rf generator's signal. There are two alignment capacitors (TC1, TC2) and an access hole for each is provided in the top cover of the FV-101. TC1 is located on the left when viewing down from the front panel of the unit. If a signal generator isn't available, a steady on-the-air carrier signal will suffice.

Well, that completes the entire modification, and the transceiver bottom cover and the FV-101 cabinet can now be replaced. You should find that the RIT control works regardless of which vfo is being used to select the receive frequency. If this is not the case, go back and check your wiring (remember Murphy). Again, be sure that the new RIT circuitry has a common ground with the FV-101 itself. I hope that you will find this modification to be as useful as I have. Good luck in the pileups! ■

References

1. *Radio Communication Handbook*, Fifth Edition, RSGB, pp. 3-12.
2. *Radio Handbook*, 21st Edition, Orr, pp. 20-29.



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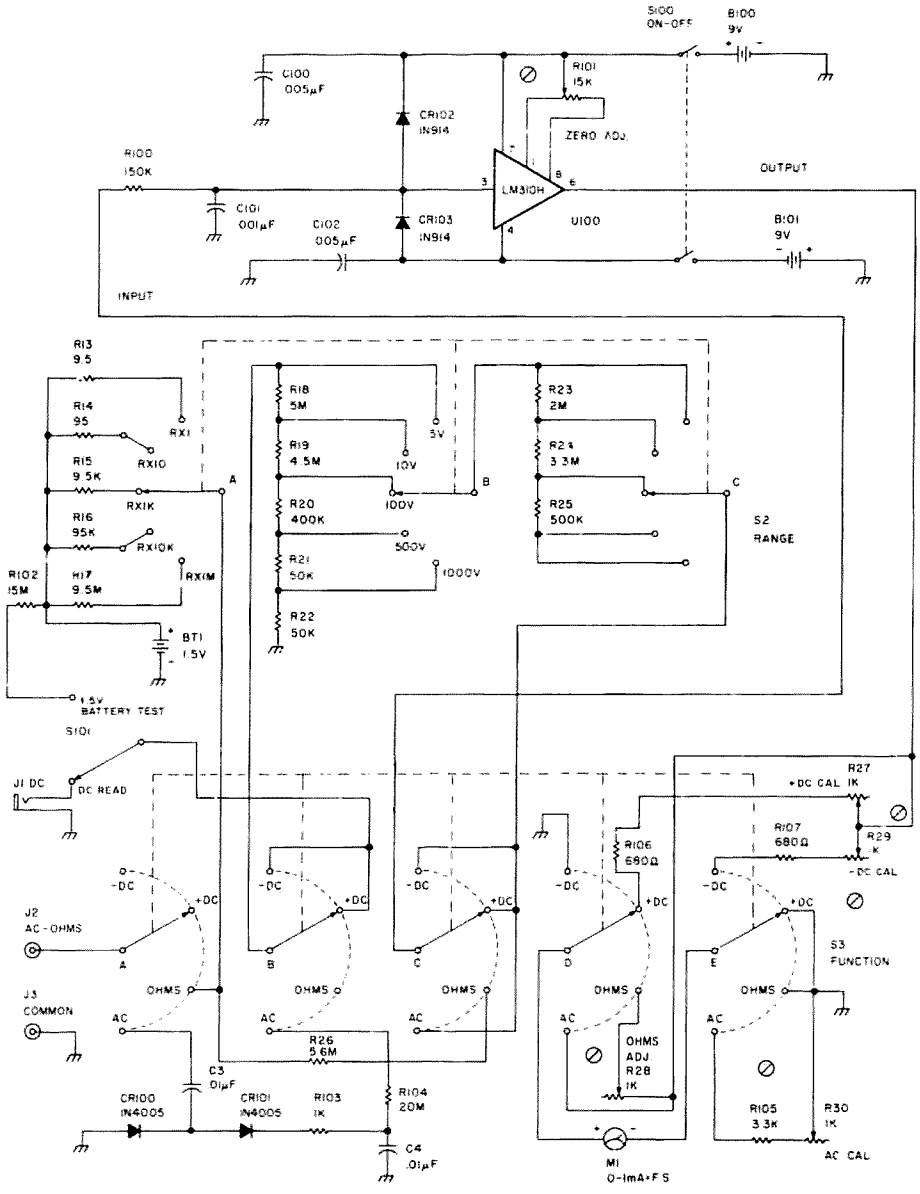


Fig. 1. Meter after conversion.

If you have scanned the meter pages of electronics catalogs lately looking for a meter with high sensitivity, you quickly become "sensitive" to high prices. Most ham auctions and sales usually will yield an Eico 221 for about five bucks. Mine cost low, as the transformer was scorched.

This conversion permits very sensitive measurements at 10 megohms per volt in solid-state circuitry and applications where ac power for a VTVM is not readily available (such as mobile gear, etc.). Though unable to measure current as some VOMAs and DVMs, its cost and sensitivity offset this shortcoming.

Mike Kaufman K6VCI did a good job on his article in *Ham Radio Magazine*, December, 1974 ("How to Convert Your VTVM to an IC Voltmeter"). He shows you how to convert the Heath IM-11. In comparing his arti-

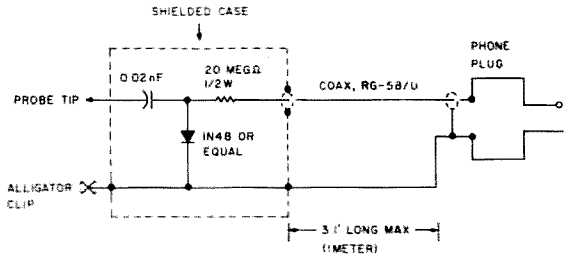


Fig. 2. Rf probe circuit.

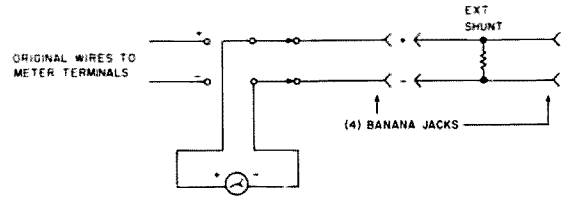


Fig. 3. Milliammeter circuit.

cle with converting the Eico 221, I noticed some differences.

This article will show you how to enjoy the original features of the Eico 221, yet have a meter that is totally battery-operated. Conversion is relatively simple for the average builder-hobbyist.

Fig. 1 shows the meter after conversion. It would be helpful to have the original construction manual when doing the modifications. I didn't enclose photos of the conversion as the text is fairly descriptive.

Note the parts in Fig. 1 designated "100" as "U100". These are new parts you add. Most are available from Radio Shack, Poly Paks, etc. See the parts list for descriptions.

This conversion is begun by removing unnecessary components. See your Eico 221 book for parts locations if they are not clear. Parts with an asterisk (*) are on the Function switch, S3. Remove (and put in your junk box): The ac line cord, On-Off switch (S1), power transformer (T1), pilot lamp (B1) and holder, all tubes (V1-V3), resistors R1 (10k, 2 W), R2 (33k, 2 W), R3 (20k), R4 and R6 (1.5 megohms), R7 (5 megohms), R8* (1 megohm), R9 (5 megohms), R10 and R11* (1k), capacitors C1 and C5* (0.002 μF), C2 (filter), and C4* (0.01 μF). Save C4* for conversion. Also remove potentiometers R5 (2 megohms, Ac Zero Adjust) and R12 (2k, Zero Adjust).

Install R101 (15k) in the front panel hole where R12 was. If you strip the chassis clean, except for adjustment pots and their wiring, you removed all of the above parts. Do not disturb the wires on or to Function or Range switches at this time. Cut any of the wires from these switches at the chassis end and tag them as to original connections. If you use the tube sockets for the new circuit, leave them as is. Enlarge the hole in the panel where the pilot lamp holder was to 1/2-inch (12.7mm) diameter and

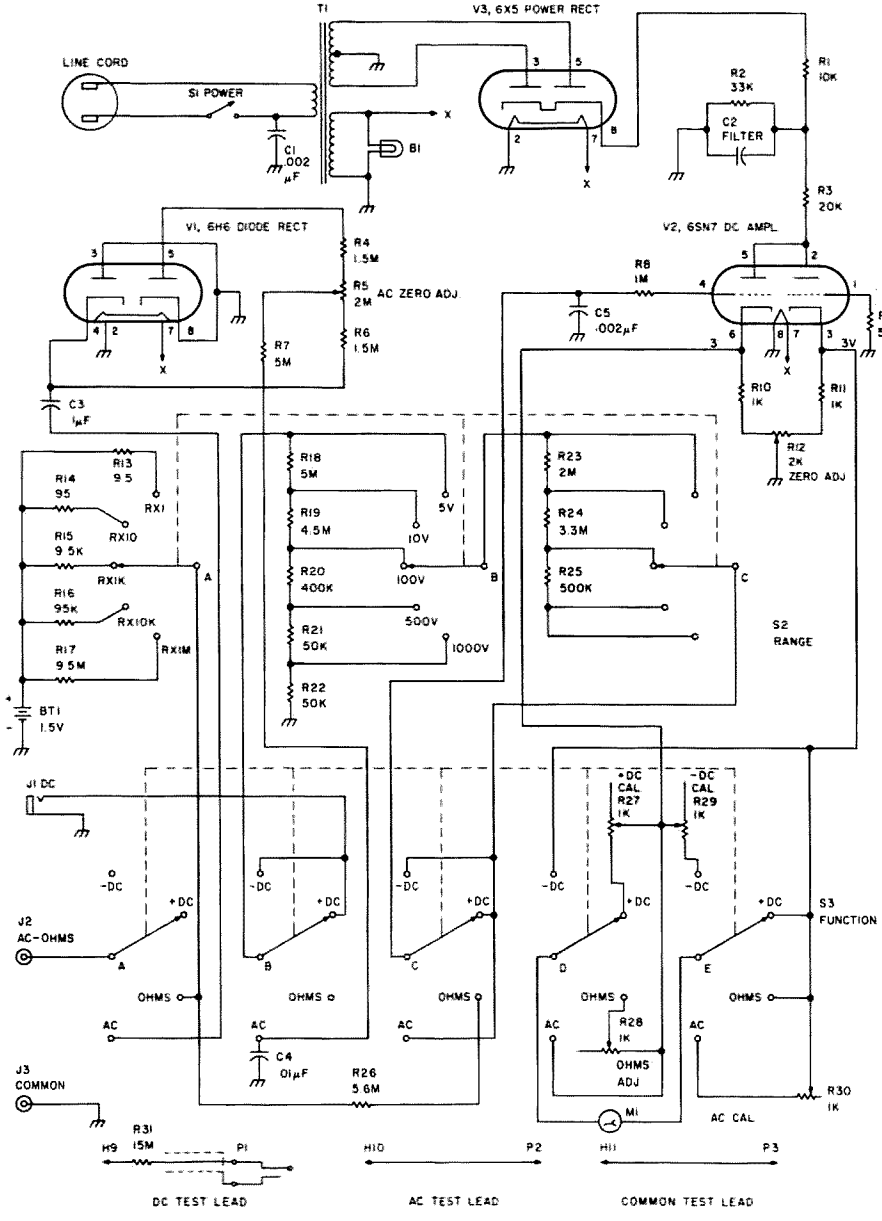


Fig. 4. Meter before conversion.

Parts List	
B100, B101	9.0-volt transistor battery with connectors (battery holders optional)
C100, C102	0.005-μF, 50-volt mica
C101	0.001-μF,50-volt mica
CR100, CR101	1N4005 or equivalent 600-plv,1-Amp diode
R100	150k, 1/4 W, 10%
R101	Pot. 15k, 1/2 Watt, panel-mount type
R102	15 meg, 1/4 Watt, 10%
R103	1k, 1/4 Watt, 10% (can use old R10 or R11)
R104	20 meg, 1/4 Watt, 10% or (2) 10 meg, 1/4 Watt, 10% in series
R105	3.3k, 1/4 Watt, 10%
R106, 107	680 Ohms, 1/4 Watt, 10%
S100	toggle switch, DPST
S101	toggle switch, SPDT
U100	IC, National Semiconductor LM-310H voltage follower

mount switch S101 (1.5-V Battery Test switch). This switch does two things—it fills a vacant hole, but more important, it allows you to test the ohmmeter 1.5-volt battery. Break the wire from the Function switch to J1 (dc jack) and wire in this switch. R102, the 15-megohm resistor, can be mounted on Range switch S2.

Mount switch S100 in the hole where the original On-Off switch (S1) was located. Batteries B100 and B101 may be mounted in special clips available for them or mounted to the chassis with cable ties or strapping tape. Use connectors that mate them or make your own from discarded 9.0-volt batteries. Batteries need replacing periodically, so soldering them is not advisable. U100 can be soldered into one of the existing tube sockets or push out one of the transformer grommets and insert a round nylon 8-pin IC socket in the hole and wire to the socket.

All remaining parts may be wired to the two remaining sockets or mount to some 3-lug solder strips mounted on the chassis. A perforated Vectorboard® could also be used. This part of the conversion is mostly left up to the hobbyist's ingenuity. C4 was on the Function switch and is relocated on the chassis. Use insulated hookup wire for all wiring. Lead dress is not critical, but capacitors C100, C101, and C102 should be wired close to U100. R106 and R107 can be mounted on Function switch S3. Break the wiring to R27 and R29 and insert them in series. R105 is inserted from R30 to S3, deck E. Break wiring to R30 and put in series. Be sure to ground the wire which went to pin 3 on the V2 (6SN7) socket and decks D and E on the Function switch.

Theory of Operation

Capacitors C100 and C102 bypass the battery power supply. Diodes CR102 and CR103 prevent an overvoltage condition if you are probing a large voltage while the meter is switched to a low-voltage range. They limit voltage on U100, pin 3 to ±9.0 volts dc. Resistor R100 limits current into CR102 and CR103 and forms part of the protective circuitry. Capacitor C101 keeps any ac out of U100's input. Its value is not critical except increasing its value will increase the measuring time. Potentiometer R101 is the new Zero Adjust pot.

Diodes CR100 and CR101 replace the original 6H6 diode circuit. They should be at least 600-piv, 1-Amp types. CR100 clips the negative half of the cycle to ground after coupling through capacitor C3. CR101, R104, and R103 "steer" the positive half of the cycle to the Function switch and Range switch circuit as dc input does. C4 bypasses any stray ac to ground.

Calibration

With unit power off and the S101 1.5-V Battery Test switch set to Dc Read, adjust the mechanical zero screw on the meter until the needle points to zero. Turn the S100 meter power switch on and adjust the Zero Adjust control (R101) until little or no change occurs when the Function switch goes from +dc to −dc with no probe input. Probe a known dc voltage and adjust the Dc Cal control for the correct meter reading. Position the 1.5-V Battery Test switch to read the ohmmeter battery on the 5-V scale. You should read about 1.5 volts on a new battery. Position it back to Dc Read. Next, switch the Function switch to the Ohms position and set the Ohms Adjust control on the front panel so the meter reads infinity resistance (on left side of scale) with the resistance probe open-circuited (not shorted to the ground probe). Touching these probes together will bring the needle to read zero Ohms on the right side of the meter scale.

Never leave the meter in the Ohms position or S101 in the 1.5-V Battery Test position as the latter disables the meter from reading dc and the first is normal procedure. The battery could drain over a few months. Finally, put the Function switch in the Ac position and adjust the Ac Cal pot until a known ac voltage reads correctly on the meter. Caution: Do not use the ac line to calibrate this meter as one side of the line will always be on the panel and chassis and a serious shock could result. A suggested method is to use a 6.3-V-ac transformer and calibrate the meter on the 10-V-ac range, comparing the reading with a known good meter.

Always turn this meter off when not using it, as the LM-310H draws about 4 mA and will consume the batteries in a period of time. An LED Power On indicator would consume 20 mA from the power supply, so it was not part of this conversion.

Another useful application in ham radio for this conversion is to use an rf probe into the ac input and measure relative power output and antenna field strength. A short piece of wire or a clip lead on the end of an rf probe will pick up enough rf energy to give a good reading. Eico had a model PRF-25 probe available for this VTVM, or a simple probe may be made with a 1N48 diode, a 0.02-μF, 600-V capacitor, and a 20-megohm, 1/2-Watt resistor in a shielded tube or enclosure. See Fig. 2.

If you still need a milliammeter, the basic movement here is 0-1 mA dc full scale. Mount a DPDT switch on the front panel and wire the meter terminals to the common contacts. Wire two banana jacks to the normally-closed contacts and connect the two original meter wires to the normally-open contacts (see Fig. 3). The banana jacks could be mounted on the back of the cabinet. Of course, the main on-off switch stays off to use the 1-mA function. By experimenting with resistor shunts across the banana jacks, this 1-mA range can be extended to several Amps. Start with about 90 Ohms and go as low as 0.1 Ohms and compare the reading with another milliammeter in series with this meter between a dc power source and a load. With the proper shunt, this meter should track the known meter. ■

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It is very convenient when the bandwidth of a ham receiver can be adapted for different circumstances. That is to say, to the kind of signal to be received—telephony, telegraphy, RTTY, FAX, etc., and to the interference caused by other stations which, especially on the HF bands, is practically unavoidable.

Commercial receivers and transceivers sometimes offer the possibility of selectable bandwidth. That is realized by providing several i-f filters with different passbands that can be selected by a switch. In order to keep the initial price low, often a single filter is built in as standard and the extra filters can be ordered separately for a considerable amount of money. The price of i-f filters is the reason that even the "deluxe" transceivers and receivers usually provide only limited choice of bandwidth.

For the home-brewer who constructs a modern receiver with a high intermediate frequency, say over 4 MHz, the possibilities are no different than those for the professional designer. He, too, must buy a separate, expensive bandpass filter for every value of bandwidth desired. It is in principle possible for the amateur to make his own crystal filters, but this remains a tricky business and it is difficult, if not impossible, to realize a predictable bandwidth.

But there is a different way. We can construct a multi-resonator bandpass filter using coils and capacitors on a relatively low i-f—50 kHz for instance. It is not difficult to make the passband width of such a filter switchable to as many different values as we desire. Such a low i-f dictates the use of double- or triple-frequency conversion in a superheterodyne receiver for the HF bands in order to retain a reasonable attenuation of image responses. That may seem a bit outdated, but when the receiver is carefully designed, this should not pose insurmountable problems. Even in some famous commercial receivers, like the Drake, this system is used.

For my own ham-shack receiver, which I constructed some seventeen years ago, I followed this approach using a final intermediate frequency of 50 kHz. This receiver still copes fully with conditions on the amateur bands of today. The original filter was made with seven capacitively-coupled resonant circuits, and the passband was 2.7 kHz wide.

That was OK for single sideband, but for other modes, like CW and teleprinting with the "hell" system (see Hans Evers PAØCX (DJØSA), "The Hellschreiber, A Rediscovery," *Ham Radio*, December, 1979), I began to feel the need for some smaller bandwidths. That was the reason I replaced the seven-circuit bandpass filter with fixed passband by an eight-circuit one having selectable bandwidth. Together with passband shift, this gives me the capability to match the receiver bandwidth to the actual receiving conditions in an optimum way. This filter is the subject of this article.

It may be of interest that I use a similar filter in my homemade single-sideband transmitter for the bands 10 to 160 meters. That filter employs six tuned circuits on about 20 kHz. Sideband and

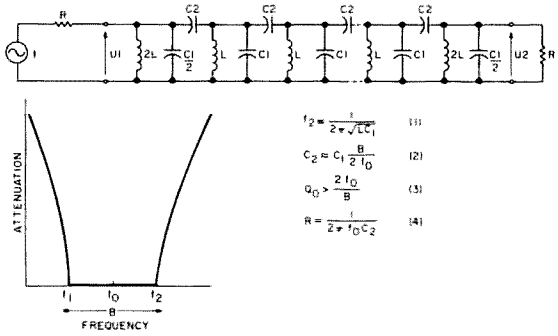


Fig. 1. Basic circuit of a capacitively-coupled bandpass filter.

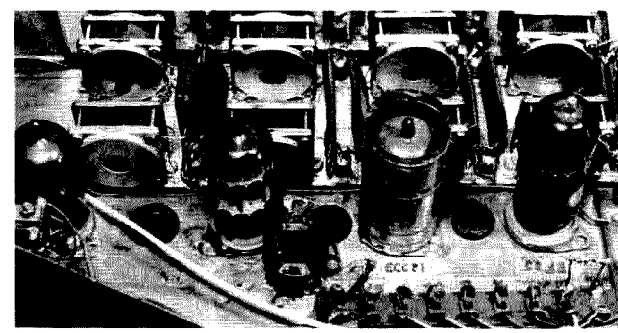


Photo A. The filter mounted in PAØSE's homemade hamband receiver.

carrier suppression are extremely good and stable and the quality of the SSB signal can successfully compete with any modern conception.

Principle and Design—A Switchable I-f Filter

The principle of an LC filter with capacitive top coupling is indicated in Fig. 1. At the left is shown how the passband is defined as the frequency difference between the upper limit, f_2, and the lower limit, f_1. f_0 is the so-called central frequency. The band between f_1 and f_2 is called the passband with width B.

Modern filter theory permits one to design a bandpass filter using this configuration with predictably exact characteristics. That is to say, we can prescribe f_1 and f_2 and also the slope of the transitions between the passband and the stopbands below f_1 and above f_2.

The values for coils and capacitors can be found by computation and also in recipe books for filters. But the awkward thing about it is that all coils and capacitors usually end up with different and odd values for self-inductance and capacitance—37.21 pF and 9.82 mH or so, for instance. When the passband width should be switchable, the situation becomes even more embarrassing because the values of all coils and capacitors have to be changed.

It is easier, therefore, for the amateur constructor to design the filter according to the classical "image-parameter" method. The disadvantage of this approach is that the filter characteristics cannot be predicted exactly when using non-ideal components and filter terminations. Also, the transitions between pass- and stopbands will be less steep than for an optimal filter designed using modern filter theory. But the pleasant aspect of an image-parameter filter is that all filter sections except the first and the last are similar.

Fig. 1 is applicable, too, for a filter designed by classical filter theory. All coils have the same self-inductance value, L, except the first and the last coil; these have 2L. Also, all parallel capacitors are similar with value C_1, except again for the ones in the end section which are of value $C_1/2$. Coupling capacitors C_2 are all similar, and they determine the width of the passband.

Let us now take a look at the formulas in Fig. 1. The first shows that upper limit f_2 of the passband is determined by the resonant frequency of the parallel tuned circuits on their own. That is, L in parallel with C_1 for the intermediate sections and 2L in parallel with $C_1/2$ for the end sections.

At lower passband limit f_2 each coil resonates with the total capacitance connected to it: for the intermediate circuits, L in parallel with $C_1 + 2C_2$, and for the first and last section, 2L in parallel with $(C_1/2) + C_2$.

With some approximations, the second formula can be derived from this, allowing us to compute C_2 for a desired bandwidth, B. As already stated, this is an approximation: The actual bandwidth obtained can deviate considerably from the computed one. It is useful as a starting point, however, and the actual value for C_2 necessary for a certain bandwidth, B, can be found quickly enough by experiment.

The third formula is an important one. It indicates the minimum circuit Q_0 required in order to obtain a certain bandwidth. The narrower the passband desired, the higher Q_0 has to be. This shows why we cannot construct the filter for a high intermediate frequency. Say that we want B to be 2.5 kHz and $f_0 = 9$ MHz. The minimum circuit quality, Q_0, in this case has to be $(2 \times 9000)/2.5 = 7200$. No coil will ever be that good, but quartz-crystal resonators are, and these indeed are used in such i-f filters.

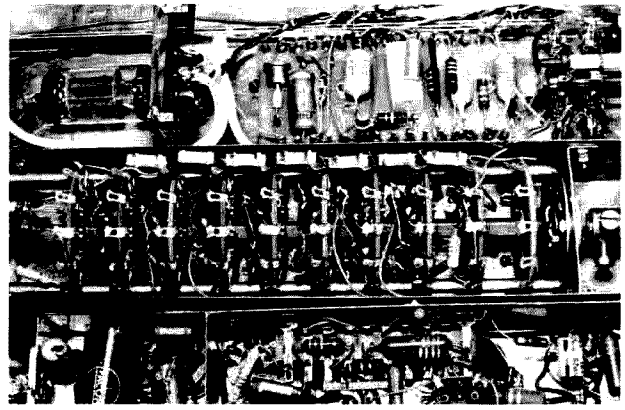


Photo B. View of the filter from the bottom of the receiver. Coupling capacitors and loading resistors are mounted directly on the switch decks.

So we should start by making the best coils we can at the chosen intermediate frequency, f_0. (The Q of the capacitors is usually so much higher than that of the coils that Q_0 of the circuit is set by Q_0 of the coils alone.) For the frequencies concerned, we have to make use of ferrite pot cores and Litz wire. The ferrite should be suitable for the frequency we want to use. The bigger the pot core, the higher Q_0 becomes. Also, we should try to fill the space inside the pot core completely with the winding. How the Q of the circuit can be measured will be shown later.

For my own filter, with f_0 about 50 kHz, I used 1-inch ferrite pot cores of Philips manufacture. It is a now-obsolete type, designated as K300063. The coil has a slug for fine-tuning. No doubt suitable ferrite pot cores of other manufacture can be obtained outside my country.

I tried several types of Litz wire from my junk box, even home-brew, made by twisting two insulated 0.25-mm (30 AWG) wires. But the highest Q was obtained by using 28 × 0.05 Litz wire (28 strands of 0.05-mm diameter) that was kindly provided by PA0LQ from his personal store. Q_0 varies a bit from coil to coil but is of the order of about 370.

We now know the minimum passband width we can obtain, because from the third formula comes $B_{min} = 2f_0/Q_0$, and $2 \times 50000/370 = 270$ Hz. We can get even narrower passbands, but the insertion loss in the passband then increases quickly. The tuned circuits become undercoupled—something you may remember from the theory of double-tuned circuits.

Finally we have the fourth formula. That one states that the end sections of the filter shouuld be loaded by a resistor the value of which is equal to the reactance of the coupling capacitors, C_2. This is not very critical. We may use a somewhat greater value for R than the formula prescribes, but if we go too high, ripples in the passband appear. We should also realize that the loading resistor, R, assumes theoretical, that is, lossless, coils. In the real world coils do have losses, and the losses in the first and the final coil already provide some of the loading. This implies that at the narrowest bandwidth the external loading resistors can be omitted, as all loading is already provided by the "loss

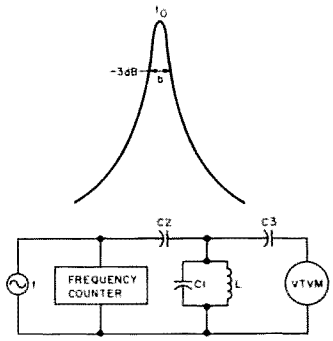


Fig. 2. How unloaded quality factor Q_0 is measured.

resistance" of the coils themselves.

Making the Filter

How do we make the actual filter we would like to possess? That is largely dictated by what your junk box provides in the way of capacitors of equal values. I assume you already possess or can obtain suitable ferrite pot cores. When we start by fixing C_1, then L is set as well, according to formula one. We now try to obtain the correct L with wire that fills the coil form as much as possible. (Note that the end coils have double the self-inductance!) If the choice of Litz wire is limited, we can also start by making the coils, filling the coil forms completely. The self-inductance, L, is then measured, and from this follows C_1.

Capacitors C_1 should be of good quality, mica or polystyrene. A small tolerance of capacitance value is nice to have but is not a must. We have to tailor the number of turns for each individual coil, anyway. Differences of up to 10% between the individual coils and capacitors do no harm as long as each parallel circuit can be tuned exactly to f_0.

I had a small batch of 2.5-nF mica capacitors for the intermediate sections. For the end sections, the capacitors should therefore be 2.5/2 or 1.25 nF, but those were not available. The junk box did provide capacitors of 1.35 nF, however, so these were used. The self-inductance of coils 1 and 8 had to be corrected for this, of course. The coils for intermediate sections 2 through 7 worked out at a self-inductance of 3.74 mH. That is a value I calculated after completion of the filter because, as stated already, the coils are individually tailored to the capacitors they are used with.

We start by putting in more turns than are necessary (according to the formula provided by the maker of the pot cores for obtaining a certain value of self-inductance). The coil is now temporarily assembled without the tuning slug. We now rig up the circuit of Fig. 2. C_1 is the capacitor that will be used with the coil under construction. C_2 and C_3 are as small as possible consistent with a reliable indication on the VTVM (a scope can also be used).

We now tune for resonance, as indicated by a maximum of the voltage over the circuit. This is very sharp! The frequency of resonance will usually be lower than f_2 as defined in Fig. 1. We now remove one or two turns of the coil and measure again. (That sounds worse than it is: The wire removed is simply left in the circuit; it has negligible influence on the frequency of resonance.) During the measurement, I simply press the two halves of the pot core together by hand.

We go on taking off turns until the resonance frequency is just slightly higher, say 2%, than f_2. We now can finally assemble the coil and insert the slug. If all is well we can now tune neatly around f_2.

It all sounds a bit complicated, but is the only method that guarantees tuning the circuits properly to the correct frequency. Only when you are lucky enough to have very small tolerance capacitors available (1% or better) can you wind all coils with the same number of turns, as calculated for your particular pots to reach the required self-inductance. The reason is that the slug permits only a small variation of the coil's self-inductance—some 2% or so.

In this way we proceed for all the tuned circuits, eight in my case. When the tuned circuits are ready, we can mount them on some suitable support. How you do this is not so important. But try to do it in such a way that input and output of the filter are well separated; otherwise some signal may bypass the filter in the stopbands. I used a kind of channel made of tin-plate—as can be seen in the photographs. The coils and the parallel capacitors are mounted on top; the switch and the coupling capacitors are inside the channel.

The complete circuit diagram of the filter is shown in Fig. 3. The number of different passband widths that you put in is up to you. It will probably be determined by the kind of switch you have available and the number of equal-valued capacitors in your junk box. I had a 12-position switch of which 10 positions are used.

As you can see in Fig. 3, there is a small capacitor, 3.3 pF in my filter, always in circuit. This was provided for alignment purposes. It is convenient when all circuits can simply be tuned to maximum on a test signal.

We can find a suitable value for the small coupling capacitor as follows. From the measured Q_0 of the coils, find the minimum passband width possible using the third formula. Entering this bandwidth, B, into the second formula then gives you the corresponding C_2. If you now take half of this value for the capacitor that is always in circuit, you will be OK. When the small coupling capacitors have been put in, we can start aligning the filter.

We need some indicator, like a VTVM or a scope, and we couple it lightly to the last circuit, number 8 in my case. Coupling can be done via a small capacitor. We also need some generator that is tuned to upper frequency limit f_2 of the filter passband. The generator is connected in parallel with circuit 7. It does not matter if this circuit is heavily damped by the generator. We now tune circuit 8 for maximum voltage.

Next, the generator is moved to circuit 6 and number 7 is tuned for maximum voltage. Then the generator is moved on to circuit 5 and circuit 6 is tuned for maximum voltage, and so on. If the signal on the last circuit becomes too weak for a reliable indication, we move the indicator to number 7 or 6. So we finally come to circuit 1.

The generator is now lightly coupled to 1 via a small capacitor in order not to detune it under the influence of the generator. When circuit 1 is also peaked, alignment is completed for circuits 2 to 7. We can fix the slugs with wax to make them stay put. Circuits 1 and 8 will get a final touch-up once the filter is mounted in the receiver to compensate for the capacitance of the stages preceding and following the filter.

Now you can start putting in the coupling capacitors for the switch positions you are going to use. It is simply a matter of soldering them

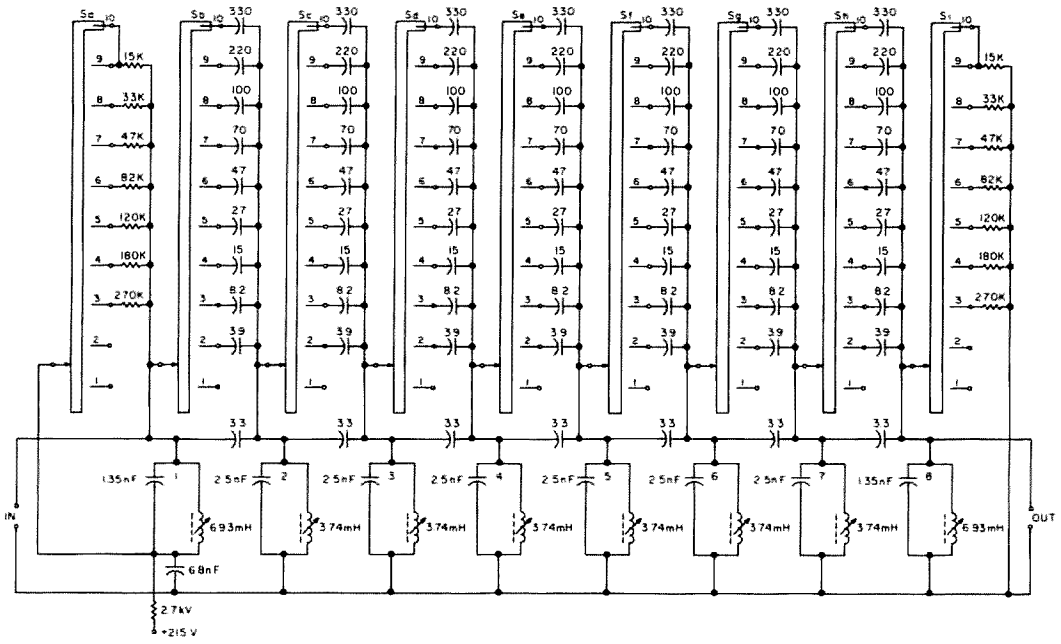


Fig. 3. The actual circuit diagram of the filter with selectable bandwidth. Capacitor values in picofarads unless designated nF (nanofarads). Sa through Si are the decks of the bandwidth-selector switch.

directly to the switch contacts and seeing what you get in the way of passband. No further alignment is necessary. In Fig. 3 you can see what I used, and Table 1 gives you the results I obtained. Position 1 gives the smallest bandwidth, 132 Hz, and this is with only the 3.3-pF capacitors in place. As stated, this switch position is intended for alignment only, but in practice it turned out to be useful as an operational position as well.

Switch decks Sa and Si are used to connect the proper loading resistors in parallel with the first and the last circuit. The values of these resistors can be found easily; they are equal to the reactance of the total coupling capacitance, C_2, in effect at each switch position. For positions 2 and 1, no resistor is required as the loss resistance of the coils themselves provides the loading.

You see that the resistors become smaller as the bandwidth increases. This means that the input resistance of the filter, as "seen" by the stage driving it, also decreases. And since the amplification of the stage feeding the filter is equal to the mutual conductance of the tube or transistor multiplied by the input resistance of the filter, this amplification also decreases as the filter bandwidth becomes wider. This effect is slightly compensated for by the fact that the insertion loss of the filter goes down as the circuits become more tightly coupled, but this compensation is only small because this filter loss is only of the order of one dB for the wider bandwidths.

This effect is also shown in Table 1. The total amplification between the input of the stage preceding the filter and the output of the filter was measured for the different switch positions. The amplification in switch position 2 was put at 0 dB as a reference. The table shows what happens in the other positions. Actually, the value in position 10 should be more than −21 dB, but I chose to use the same loading resistance, 15k Ohms, for positions 9 and 10 in order to keep the total amplification from going down too much. The underloading in position 10 is noticeable as a slight ripple in the passband that does no harm.

I first intended to make the total amplification the same for all switch positions by switching in suitable resistive attenuation networks on the output side, and I reserved a switch deck for that purpose. It is the one nearest the front panel of the receiver in Photo B. But I finally rejected that refinement. The difference in receiver gain is hardly noticeable under the compensating influence of the automatic gain control. Only if you would like to have the S-meter calibration hold for all switch positions should you include the loss equalization. My S-meter is used only as an uncalibrated indicator.

Table 1 gives the measured bandwidth at −6 and −60 dB with respect to the maximum in the passband. From that, the shape factor is computed and it approaches 1.7 when the bandwidth is 2.70 kHz or wider. A very good figure, I think.

The shape of the filter attenuation characteristic was also measured. Fig. 4 shows two of the curves, for switch positions 5 (1.11 kHz) and 9 (7 kHz). It is shown clearly that the upper limit of the passband remains at about 52 kHz and the lower limit moves down as the bandwidth increases.

Position of the switch	1	2	3	4	5	6	7	8	9	10
Bandwidth at −6 dB (passband)	132 Hz	177 Hz	361 Hz	638 Hz	1.11 kHz	1.91 kHz	2.70 kHz	3.64 kHz	7.03 kHz	9.36 kHz
Bandwidth at −60 dB	580 Hz	715 Hz	1.04 kHz	1.50 kHz	2.20 kHz	3.41 kHz	4.71 kHz	6.32 kHz	12.2 kHz	16.0 kHz
Shape factor B_{60} dB/B_6 dB	4.4	4.0	2.9	2.3	2.0	1.8	1.7	1.7	1.7	1.7
Attenuation at f_0 with att. in pos. 2 as reference	−7.0 dB	0 dB	−6.5 dB	−5.5 dB	−6.5 dB	−8.5 dB	−12 dB	−15 dB	−21.5 dB	−21 dB

Table 1.

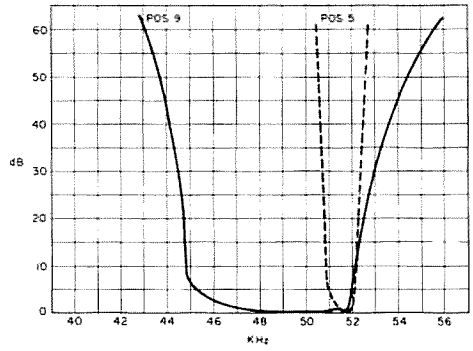


Fig. 4. Measured filter response in switch positions 5 and 9. Response continues beyond −60 dB, but this could not be measured with the simple test equipment at PAØSE.

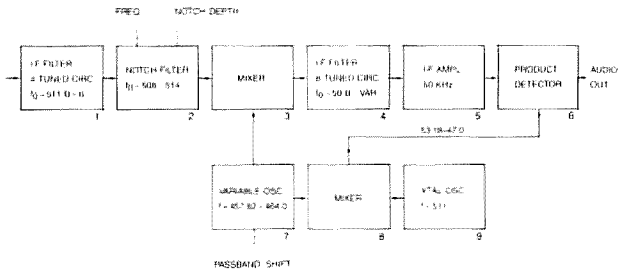


Fig. 5. Block diagram of second and third i-f sections in PAØSE's receiver, incorporating passband shift. Frequencies in kHz.

The attenuation extends beyond 60 dB but I was unable to measure deeper down with the unsophisticated test equipment in my home lab. You can see in Fig. 3 that the "cold end" of circuit 1 is not grounded but connected to +215 V. It is decoupled by a 68-nF capacitor. This was done because the filter is fed from a pentode tube and it receives its anode voltage via the first circuit.

Finding Q_0

The unloaded quality factor, Q_0, of the parallel tuned circuits is also measured using the setup in Fig. 2. C_1L is the circuit under test. First find frequency f_0 of maximum response. Now detune the generator slowly to the frequencies at which the voltage is −3 dB (0.707 times) with respect to the maximum voltage. The frequency difference between those two points is designated b.

We now find Q_0 from $Q_0 = f_0/b$. A frequency counter is almost a must since the frequency differences we deal with are very small. The coils I used have a Q of about 370, as mentioned earlier. That means that at 50 kHz the frequency difference between the −3-dB points is 50,000/370 = 135 Hz.

We do not want to load the circuit by the internal resistances of generator and indicator. This is done by keeping C_2 and C_3 small. To make sure the extra loading by generator and indicator does not influence our result, we can repeat the measurement using the next bigger or smaller value for C_2 and C_3. If the value of Q_0 is the same in this case, we know we have a good result.

Passband Shift

The receiver in which the filter is used also features passband shift, or passband tuning as it was called earlier. This means that the passband can be shifted up or down over the signal without affecting the tuning of the receiver. In conjunction with the passband width selection, this offers unique possibilities for getting rid of QRM. With one hand we move the bandwidth switch to progressively smaller passbands and with the other we adjust the passband shift to put the passband in the optimum position over the received signal.

In my receiver I even have an adjustable notch filter in the 511-kHz i-f preceding the final 50-kHz i-f. This was put in when I had the fixed 2.7-kHz filter at the final i-f. The notch could be used to remove an interfering heterodyne on the wanted signal. Since I replaced the 2.7-kHz filter with the one described here, there is no need to touch the notch filter any more.

How the passband shift is effected will not be described here in detail. Only the principle will be shown, with the help of the block diagram, Fig. 5.

The receiver has a first tunable i-f of 3.5 to 4.5 MHz. The second i-f is 511 kHz. Selectivity on this frequency is provided by a bandpass filter with four tuned circuits. Bandwidth is about 6 kHz. This filter is indicated as 1 in Fig. 5. It is followed by a notch filter (2) with adjustable rejection frequency and notch depth. (As mentioned, this is more or less superfluous with the variable i-f filter now used.) The second i-f at 511 kHz is converted to 50 kHz in the mixer (3). This frequency is the difference between the 511-kHz signal and the oscillator signal from the variable-frequency oscillator (7). This oscillator affects the passband shift, and its frequency can be varied between 457.82 and 464.0 kHz.

This means that a signal at the center of the second i-f at 511 kHz can be shifted between 511−457.82 = 53.18 kHz and 511−464.0 = 47.0 kHz. That is to say, the spectrum of input signals offered to the third i-f filter at 50 kHz can be shifted upwards and downwards.

The output signal from the switchable bandpass filter (4) is amplified (5) and presented to the product detector for conversion to audio. In order to keep the tuned frequency the same when shifting the passband, the oscillator signal for 6 (bfo signal) should be shifted the same amount up or down as the shift of the input signal for the filter (4).

This is realized by mixing the signal from oscillator 7 also with that from a crystal oscillator at 511 kHz (9) in the mixer (8). The output signal of 8 is filtered and it has a frequency between 47.0 and 53.18 kHz, just the same as the signal at the filter input that resulted from a 511-kHz signal at the second i-f.

So although it looks as if the passband of the filter is moved back and forth over the signal, in reality the signal is moved up and down at the filter input and the bfo frequency is moved with it.

There are a few things to be watched with this system. One is that the crystal oscillator (9) and mixer (8) have to be well screened because the 511-kHz signal is in the middle of the second i-f and even a small leakage signal means a standing signal in the receiver. It is always zero beat with the bfo frequency signal so it won't be heard, but it deflects the S-meter.

Also, the output signal of the mixer (8) must be well filtered; otherwise birdies will be heard when the passband shift control is operated.

Helpful in this respect also is keeping the signal from the oscillator (7) in the mixer as small as possible. I managed to get rid of birdies completely after I installed a single-section low-pass filter with a cutoff frequency of about 55 kHz between the mixer and the product detector. ■

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Curious About Code?

Learn (or improve) Morse from your TRS-80! You'll never find a more patient teacher.

This interactive program will teach or improve Morse-code skills. The program, written in Basic and Z-80 assembly language, puts out Morse code as a sequence of audible dots and dashes via the computer's cassette port. By attaching a small amplifier and speaker or simply a pair of earphones to the cassette port (see Fig. 1), one can listen to the code. The program will work with either Model I, III, or 4 Radio Shack TRS-80 computers and could be modified to work with other computers as well.

The program user is presented with several self-explanatory menus. The principal menu gives a choice of six options:

1. Setting the code speed (defaults to 10 words per minute)
2. Setting the audio pitch (defaults to 1000 Hz)
3. Typing arbitrary characters and listening to the corresponding code, which is also displayed as dots and dashes on the monitor screen
4. Listening to a sequence of ten randomly-generated five-character words
5. Listening to the code of randomly-generated characters one by one and then typing a guess (after each guess the program indicates whether the guess was correct and if not, what it should have been; after generating 20 characters the computer gives you a score of how many characters were correctly guessed and what the average delay of your response was)
6. Listening to the code of a previously-stored sentence

Options 4 and 5 allow selection of a subset of characters (e.g., A, B, F, Z, and 7) from which the random choice is made by the program. After listening to the randomly-generated sequence of ten 5-character words (menu option 4), you have the choice of repeating the same sequence, displaying the words on the monitor, or generating a new sequence.

The Basic program shown in Program listing 1 displays the menus and prompts the user. It also sets the time relations between dots, dashes, and pauses between characters and words. The program sets the length of a dash as three times the length of a dot, space between words as seven dot lengths, etc. These and other time relations can be changed by modifying program lines 350–390.

The assembly-language portion of the program shown in Program listing 2 accepts the ASCII value of a character and translates it into a Morse-code sequence of dots and dashes by accessing the code table stored in memory by the Basic section of the program (lines 1140–1260). Two bytes describe each character. The first byte gives the number of dots and dashes—n (if n is larger than 8, then the character will be ignored); the n bits of the second byte from the most to the least significant bit correspond to dots (0s) and dashes (1s). For example, the two bytes de-

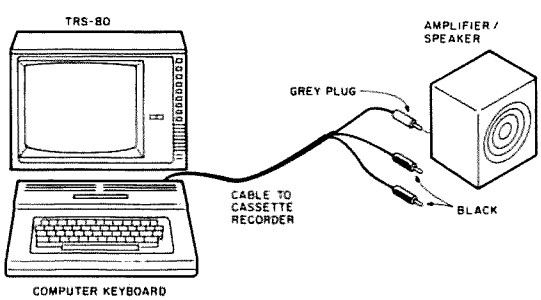


Fig. 1.

```
90 REM COPYRIGHT (C) 1983 CASS R. LEWART
100 REM MORSE CODE PROGRAM VERSION 11/25/83
110 POKE &H40B2,&HF0: POKE &H40B1,&H4E
120 CLEAR1000
130 CLS
140 DIM A$(100),C(100),P(11),M$(64),XC(64)
150 PRINT@455,"MORSE CODE PROGRAM BY C.R. LEWART"
160 PRINT"PROGRAM INITIALIZING, PLEASE WAIT ,"
170 D$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
180 D2$="1234567890": D3$="+=?,-./"+CHR$(34)+CHR$(58)
190 FOR I=0 TO 125:POKE 2*I-3846,0:NEXT I
200 PRINT".";
210 FOR I=1 TO 64:READ XC(I):Y=I:POKE 2*I-3778,XC(I)
220 POKE 2*I-3777,Y:M$(I)=" ":IF XC(I)<0 THEN 280
230 X=XC(I)
240 FOR J=1 TO X:Y=2*Y:IF Y<256 THEN M$(I)=M$(I)+".":GOTO 260
250 M$(I)=M$(I)+"-":Y=Y-256
260 NEXT J
270 PRINT".";
280 NEXT I
290 READ G$
300 PRINT".";
310 DEFUSR1=&HF050
320 F1$="###":F2$="#####"
330 S=10: F=1000
340 P(11)=INT(34135/F-10.5)
350 P(1)=0: P(2)=240/S: X1=P(2)*7: P(3)=INT(X1/256)
360 P(4)=X1-P(3)*256: P(9)=0
370 P(10)=P(2)*3:X3=325/P(11)*P(2): P(6)=INT(X3/256)
380 P(5)=X3-P(6)*256: X4=3*X3: P(8)=INT(X4/256)
390 P(7)=X4-P(8)*256
400 FOR I=1 TO 11: POKE I-3857,P(I):NEXT I
410 PRINT
420 PRINT "TO CHANGE TRANSM. SPEED ";
430 PRINT USING F1$;S;:PRINT" WPM";:PRINT TAB(36)"- 1"
440 PRINT "TO CHANGE PITCH";
450 PRINT USING F2$;F;:PRINT" HZ";:PRINT TAB(36)"- 2"
460 PRINT"ENTER CHARACTERS FROM KEYBOARD        - 3"
470 PRINT"OUTPUT FIVE CHARACTER RANDOM WORDS  - 4"
480 PRINT"OUTPUT SINGLE CHARACTERS              - 5 "
490 PRINT"OUTPUT STANDARD SEQUENCE              - 6 ";
500 INPUT G:IF G<1 OR G>6 GOTO500
510 ON G GOTO 520,540,560,660,660,630
520 PRINT: PRINT"ENTER NEW SPEED (WPM >3) ";: INPUT S
530 IF S<3 THEN 520 ELSE GOTO 350
540 PRINT:PRINT"ENTER NEW PITCH (150 < HZ < 2950) ";:INPUT F
550 IF F<150 OR F >2950 THEN 540 ELSE GOTO 340
560 PRINT:PRINT"ENTER CHARACTERS ONE BY ONE. TO LEAVE THIS MODE PRESS @: "
570 X$=INKEY$:IF X$=""THEN570
580 IF X$="@"THEN PRINT:GOTO410
590 X1=ASC(X$):IF X1<32 THEN 570
600 IF X1>95 THEN X1=X1-32
610 PRINT X$; M$(X1-31)
620 D=USR1(X1):GOTO570
630 M=LEN(G$):FOR I=1 TO M
640 C(I)=ASC(MID$(G$,I,1))
650 NEXT I: GOSUB 1120:GOTO 1030
660 G1=5:PRINT:PRINT"SELECT A-Z                 - 1"
670 PRINT"SELECT 0-9                - 2"
680 PRINT"SELECT SPEC. CHARACTERS  - 3"
690 PRINT"MAKE YOUR OWN SELECTION  - 4"
700 PRINT"PREVIOUS MENU          ENTER ";
710 INPUT G1
720 IFG1<1 OR G1>5 THEN 710
730 ON G1 GOTO 740,750,760,770,410
740 D$=D1$:GOTO790
750 D$=D2$:GOTO790
760 D$=D3$:GOTO790
770 PRINT:PRINT"ENTER YOUR CHOICE, E.G. ABCDXYZ567 ";
780 INPUT D$
790 L=LEN(D$):IF L<1 OR L>53 THEN PRINT"REPEAT":GOTO 660
800 IF G1<>4 THEN 870
810 FJ=0: FOR J=1 TO L:AS=ASC(MID$(D$,J,1)):IF AS>95 THEN AS=AS-32
820 A$(J)=CHR$(AS)
830 IF XC(AS-31)<>0 THEN 850
840 PRINT"NO CODE AVAILABLE FOR "A$(J):FJ=1
850 NEXT:I: IF FJ=1 THEN 660
860 IF G1=4 THEN 890
870 IFG=6 THEN 410
880 FOR J=1 TO L: A$(J)=MID$(D$,J,1):NEXTJ
890 IF G<>5 THEN 1000
900 PRINT:PRINT"LISTEN, THEN KEY THE CHARACTER":M1=0:M2=0:M3=20
910 PRINT:FOR J=1 TO 300:NEXTJ
920 FOR J=1 TO M3:T$=A$(RND(L)):D=USR1(ASC(T$))
930 B$=INKEY$: M1=M1+1: IFB$=""THEN 930 ELSE PRINT B$;
940 IF B$=T$ THEN PRINT " O.K." ELSE PRINT " WRONG, SHOULD BE "+T$: M2=M2+1
950 NEXT J
960 PRINT:PRINT "OUT OF "+M3+" CHARACTERS "+M2+ " WERE WRONG
970 PRINT"SCORE = "+100*(M3-M2)/M3+" %"
980 PRINT"THE AVERAGE RESPONSE TIME IN MS = "+M1/M3*40
990 PRINT"MORE (Y/N)";:INPUT Y$:IF Y$<>"Y" THEN 410 ELSE 900
1000 M=0:FOR I=1 TO 10: FOR J=1 TO 5:M=M+1
1010 C(M)=ASC(A$(RND(L))):NEXTJ
1020 M=M+1:C(M)=32:NEXT I:GOSUB1120
1030 G2=4:PRINT:PRINT"REPEAT SAME SEQUENCE    - 1"
1040       PRINT"DISPLAY ON MONITOR      - 2"
1050 IFG<>6 PRINT"NEW SEQUENCE              - 3"
1060       PRINT"PREVIOUS MENU      ENTER ";
1070 INPUT G2:IF G2<1 OR G2>4 THEN 1070
1080 ON G2 GOTO 1090,1100,870,660
1090 GOSUB 1120: GOTO1030
1100 PRINT:FOR I=1 TO M: PRINT CHR$(C(I));:NEXT I
1110 PRINT: GOTO 1030
1120 FOR I=1 TO MID=USR1(C(I))
1130 NEXT I: RETURN
1140 DATA   9,  0,  9,  0,  6, 72,  9,  0,  9,  0
1150 DATA   9,  0,  9,  0,  9,  0,  9,  0,  9,  0
1160 DATA   9,  0,  9,  0,  6,204,  6,132,  6,120
1170 DATA   5,144,  5,248,  5,120,  5, 56,  5, 24
1180 DATA   5,  8,  5,  0,  5,128,  5,192,  5,224
1190 DATA   5,240,  6,224,  6,168,  9,  0,  5,136
1200 DATA   9,  0,  6, 48,  9,  0,  2, 64,  4,128
1210 DATA   4,160,  3,128,  1,  0,  4, 32,  3,192
1220 DATA   4,  0,  2,  0,  4,112,  3,160,  4, 64
1230 DATA   2,192,  2,128,  3,224,  4, 96,  4,208
1240 DATA   3, 64,  3,  0,  1,128,  3, 32,  4, 16
1250 DATA   3, 96,  4,144,  4,176,  4,192,  9,  0
1260 DATA   9,  0,  9,  0,  9,  0,  9,  0
1270 DATA "PROGRAM TO LEARN MORSE CODE BY C R LEWART"
```

Program listing 1.

```
00100 ;MORSE CODE BY C.R. LEWART 03/02/83
00110 GETARG  EQU     0A7FH
00120 PORT    EQU     0FFH
00130 SPC     EQU     020H
00140 TABLE   EQU     0F100H  ;CODE TABLE
00150 MEMSS   EQU     0F0F0H  ;SPACE DASH/DOT
00160 MEMSL   EQU     0F0F2H  ;SPACE BETWEEN WORDS
00170 MEMDOT  EQU     0F0F4H  ;DOT LENGTH
00180 MEMDSH  EQU     0F0F6H  ;DASH LENGTH
00190 MEMEND  EQU     0F0F8H  ;DELAY AFTER CHARACTER
00200 MEMFR   EQU     0F0FAH  ;PITCH/FREQ. DELAY
00210         ORG     0F050H
00220 MORSE   DI
00230         CALL    GETARG  ;GET ASCII VALUE FROM BASIC
00240         LD      A,L
00250         CP      SPC
00260         JR      NZ,OUT1
00270         LD      BC,(MEMSL)
00280         JR      SPACE   ;PUT OUT SPACE
00290 OUT1    PUSH    HL
00300         POP     DE
00310         SLA     E
00320         LD      HL,TABLE
00330         ADD     HL,DE
00340         LD      D,(HL)  ;LOOK UP CODE TABLE
00350         LD      A,8
00360         CP      D
00370         RET     M
00380         INC     HL
00390         LD      E,(HL)
00400 LOOP1   SLA     E
00410         JR      C,DASH1
00420         CALL    DOT
00430         JR      SPACE1
00440 DASH1   CALL    DASH
00450 SPACE1  LD      BC,(MEMSS);SPACE AFTER DASH/DOT
00460         CALL    SPACE
00470         DEC     D
00480         LD      A,D
00490         OR      A
00500         JR      NZ,LOOP1
00510         LD      BC,(MEMEND);PUT OUT FINAL SPACE
00520 SPACE   DEC     BC
00530         LD      A,B
00540         OR      C
00550         JR      NZ,SPACE
00560         RET
00570 DOT     LD      HL,(MEMDOT)
00580         JR      OUT
00590 DASH    LD      HL,(MEMDSH)
00600 OUT     LD      C,01
00610 LOOP2   LD      A,C
00620         CP      01
00630         JR      Z,OUTSIG
00640         CP      02
00650         JR      Z,OUTCEN
00660         CP      04
00670         JR      Z,OUTCEN
00680         CP      03
00690         JR      Z,OUTLOW
00700         JR      OUT
00710 OUTCEN  LD      A,00
00720         JR      OUTSIG
00730 OUTLOW  LD      A,02
00740 OUTSIG  OUT     (PORT),A;CASSETTE OUTPUT
00750         INC     C
00760         PUSH    HL
00770         LD      HL,(MEMFR)
00780         LD      B,L
00790         POP     HL
00800 DEL     DJNZ    DEL     ;FREQUENCY DELAY
00810         DEC     HL
00820         LD      A,L
00830         OR      H
00840         JR      NZ,LOOP2
00850         RET             ;BACK TO BASIC
00860         END     MORSE
```

Program listing 2.

scribing the code for the letter Y (- . - -) would be 04 and B0 (hex) = 10110000 (binary). The four least significant bits do not matter in this case and can be set to 0s or 1s because Y contains only three dashes and one dot for a total of four symbols. The dots and dashes are "peeled" off by left shifting the second byte and checking the carry register after each shift.

The program as listed here will run on the Radio Shack Model I or Model III computer (also Model 4 in Model III mode) with one disk drive and 48K of RAM. The machine-language part of the program should be assembled and loaded into memory, where it will be accessed by the Basic program. Both parts of the program can easily be modified to other configurations (cassette, 16K RAM, etc.).

For information about availability of derived programs on disk or cassette for such configurations, and also for 6502-based computers (e.g., KIM 1), send an SASE to the author. A ready-to-run, single-density disk with the machine-language program stored as DATA statements for Model I, 48K, is available from C & R Electronics, PO Box 217, Holmdel NJ 07733, for $10.95 ppd. (New Jersey residents add 6% sales tax.) You can convert the disk to the TRS-80 Model III or Model 4 double-density format by means of the Radio Shack CONVERT utility.■

Scott M. Hower K7KQ
506 Sugarland Run Drive
Sterling VA 22170

WARC, Rest, and Play

Adding 10-MHz capability to your Yaesu FT-101Z is a simple step-by-step process. In just a few hours, you can join the fun on our newest amateur band.

The Yaesu FT-101Z/ZD can be modified to add coverage of the 30-meter band, allowing operation in the newly-authorized amateur segment as well as reception of WWV at 10.0 MHz. Frequency coverage following this modification ranges from 10.0 to 10.5 MHz.

When I started looking into modifying this rig, it appeared at first that adding 30 meters would not be an easy task. As most of the bandswitch lugs in the JJY/WWV position are not provided in the transmitter PA section, it is not possible simply to convert WWV operation to 10 MHz and enable the transmitter. Additionally, local oscillator and mixer components are not provided for the AUX position, although all switch lugs are in place. Therefore, a combination of WWV and AUX was used for this modification.

The WWV section was modified to receive 10.0 to 10.5 MHz rather than 5.0 to 5.5 MHz as is normally the case. Next, the bandswitch lugs for WWV and AUX were jumpered to duplicate receive operation in both bandswitch positions. Finally, the transmitter section was enabled in the AUX switch position. The result was reception of the first 500 kHz of the 10-MHz band in both WWV and AUX switch positions, with transmit operation possible only in the AUX position. This technique prohibits the addition of any future bands, unfortunately, as all switch positions are taken; however, it was the only way to add a new band to the FT-101Z/ZD.

In the FT-101Z/ZD, the 5.0-to-5.5-MHz vfo signal is mixed with a signal generated on the premix local board from a crystal oscillator. By replacing the crystal with a 24.4875-MHz crystal, the output of the mixer after modification will range from 18.9875 to 19.4875. This output signal will then be passed through a bandpass filter on the premix board to allow selection of the difference frequencies only. Following the bandpass filter, this signal is mixed with the incoming rf to produce an i-f frequency of 8.9875 MHz. This modification consists of changing the local oscillator frequency to 24.4875 MHz by replacing a crystal and a capacitor in the oscillator circuit.



Photo A. The FT-101Z.

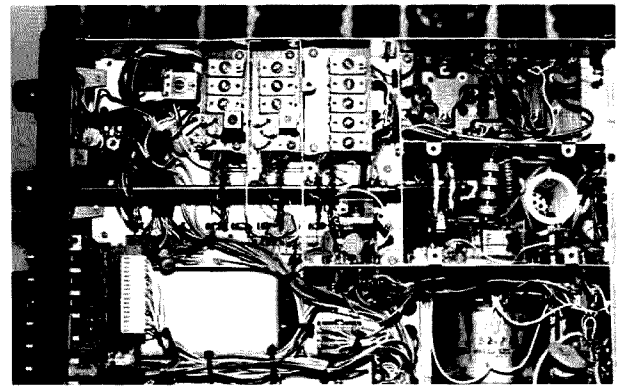


Photo B. Underside of rig showing the two new trimmers installed.

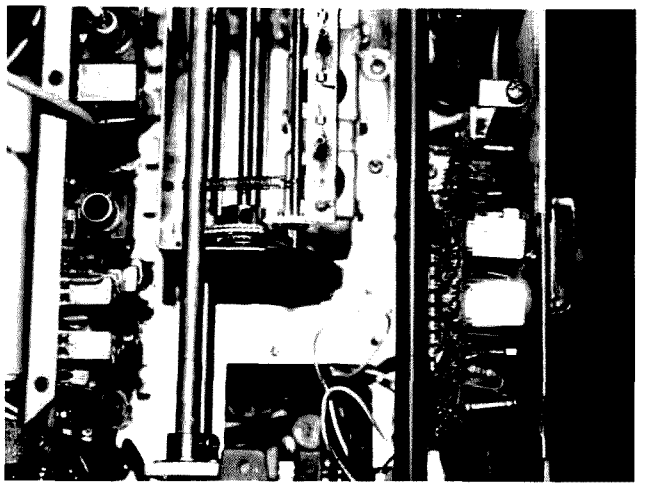


Photo C. The local board on the right and the premix board on the left, near the front of the FT-101Z.

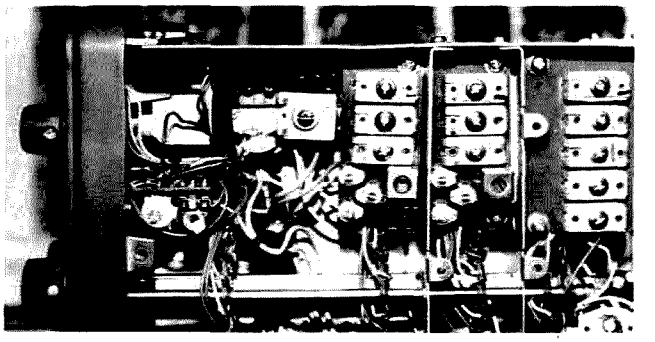


Photo D. The new trimmer capacitor may be soldered directly to the trimmer unit A circuit board.

Next, the bandpass filter frequency is shifted up to approximately 19 MHz by changing a capacitor. Additionally, trimmer capacitors must be added to the rf-input section of the receiver and the driver section of the transmitter; this is necessary because the 40-meter trimmer was simply borrowed for WWV operation in the receiver section before modification, and no trimmer was provided for the driver section. Finally, changes must be made to the final amplifier stage to allow the tank circuit to resonate at 10.0 to 10.5 MHz.

To modify the FT-101Z/ZD, proceed as follows:

1) Remove the top cover and locate the local board (PB-1965). This board is mounted vertically on the right side near the front (Photo C). Remove the board and replace X10 with the new crystal and C40 with a 160-pF silver mica capacitor. Jumper pins 12 and 13 of the edge connector, being careful to keep all solder and jumper wire away from the pins so as not to restrict plugging the board back into its socket. Replace the local board.

2) Locate the premix board (PB-1962), mounted vertically to the left of the local board. Remove the premix board and replace C27 with a 100-pF silver mica capacitor. Preset transformers T13 and T14 by first backing their slugs out all the way in a counterclockwise direction and then turning them one turn in a clockwise direction. Replace the premix board.

3) Turn the rig over and remove the bottom cover. Carefully remove the shields covering trimmer units B and C and the final amplifier compartment. Note that the bandswitch runs from S1A to S1E and S2A to S2D, with S1A closest to the front of the rig. On section S1B, first remove any jumper that may be connected between lug 11 (AUX) and the wiper arm, and then remove the jumper between lug 3 (40 meter) and lug 10 (WWV). Now add a jumper between lugs 10 and 11. Add an 80-pF trimmer in parallel with a 300-pF silver mica between lug 10 and the common side of trimmer A unit. The trimmer can be mounted by soldering its lug directly to the underside of the circuit board (Photo D).

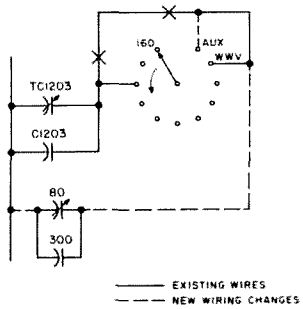


Fig. 1. Trimmer A unit.

4) On S1C, remove any jumper that may be connected to lug 11 and tie lugs 3 (40 meter) and 11 (AUX) together (Fig. 2). The trimmer B unit will have to be removed temporarily to get at the switch lugs. Simply remove the screws that hold the circuit board in place and carefully move trimmer unit B out of the way; there is no need to disconnect any wires.

5) On S1D, remove any jumper that may be connected to lug 11. Then add an 80-pF trimmer in parallel with a 270-pF silver mica between lug 11 (AUX) and the common side of trimmer unit C. The common side can be traced to an unused lug on S1E. The trimmer may be mounted by soldering directly to this unused lug (Fig. 3).

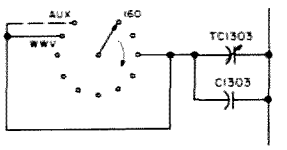


Fig. 2. S1C.

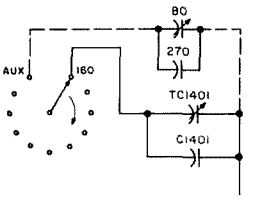


Fig. 3. Trimmer C unit.

6) S2A through D are located in the final compartment. Sections A and B are on opposite sides of the switch wafer located nearest the front, while sections C and D are on the last wafer, closest to the rear. Add a 560-pF capacitor between the AUX lug on S2A and ground. (See Figs. 4 and 5.)

7) On L1, the plate PA coil, connect a new tap 3 turns from the 40-meter tap (towards the 20-meter tap). Connect this tap to the AUX lug of S2D with #18 wire or larger. The connection to L1 can be made by carefully pushing in the turns adjacent to the desired tap point and then soldering to that point; a much easier alternative is to parallel the 40-

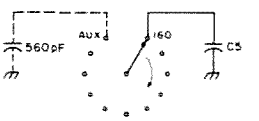


Fig. 4. S2A.

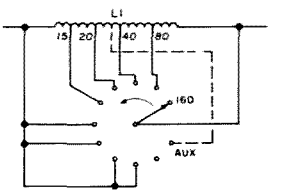


Fig. 5. S2D.

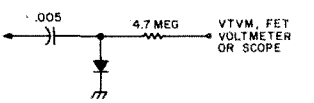


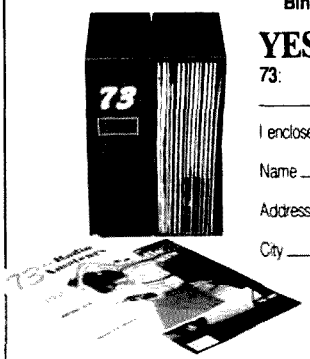
Fig. 6. A simple rf probe.

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meter tap, but this results in the plate and loading controls operating near the limit of their ranges.

This completes the modification of the rig with the exception of alignment at the new frequency. To peak the various coils on the local and premix boards, a means of sensing rf up to about 25 MHz will be necessary. If a wideband oscilloscope is not available, an rf probe can easily be constructed for use with either an inexpensive scope or high-impedance meter such as a VTVM or FET voltmeter (Fig. 6).

To align the rig following modification, place the bandswitch in the AUX position and adjust T10 on the local board for maximum output at pin 1 on that board. Now tune the vfo to 10.1 MHz and peak T13 and T14 on the premix board for maximum output from that board; J301 may be used as an output port. This is a very difficult adjustment to get at as the local board is located close and must remain plugged in. Use a small screwdriver and be patient!

Following adjustment of T13 and T14, the output level from the premix board should remain fairly constant throughout the vfo's range as this is a bandpass filter. I found this adjustment to be not very critical, however, with merely peaking T13 and T14 being sufficient. If the receiver's calibrator marker signal can be heard at 10.1, the S-meter may be used to make this adjustment (the preselect control should peak somewhere in the 10-meter range).

Once T13 and T14 have been adjusted, you should be able to hear the receiver's marker at 10.1 MHz although the preselect control probably will have a broad peak or two peaks. You need to tune the preselector to that peak which increases when you adjust newly-added trimmer A (connected to S1B). If the signal goes down when you adjust the new trimmer, you have the preselect control tuned to the wrong peak. Maximize the signal by adjusting the vfo, the preselector, and the new trimmer A. One distinct peak should be observed now when adjusting the preselect control. To observe the best peak on the S-meter and to aid in fine adjustments, the front panel agc switch should be in the fast position.

Modification and alignment of the receive section is now complete, and 30-meter signals should be heard with an antenna connected to the rig.

Alignment of the transmitter section consists only of adjusting the newly added trimmer C (at S1D) to peak the driver output. This is done with the vfo set to 10.125 MHz and the preselector peaked for maximum receive strength of the calibrator signal. Without adjusting the preselect control further, peak the new trimmer C for maximum drive by observing rf output or PA current. Use as little drive as possible, keeping PA current below 100 mA, and resonate the plate and loading controls as soon as output is obtainable. Be careful not to maintain a key-down condition for long periods of time. Increase the drive level to full output, recheck plate and loading, and peak new trimmer C a final time. This completes alignment of the transmitter section.

No modification is required to make the digital counter in the FT-101ZD operate correctly, as it simply reads the new frequency at the output of the bandpass filter and converts this to 10.0 MHz. Sensitivity and power output are comparable to the other bands, and no problems were encountered during tune-up or normal operation. The preselect control should peak somewhere in the 10-meter band area, while the plate and loading controls should be near mid-range. ■

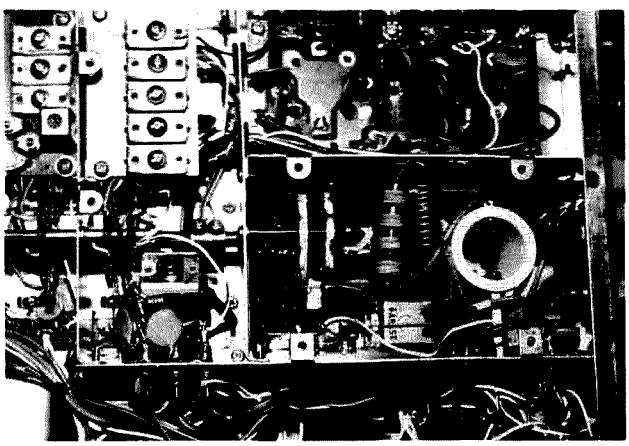


Photo E. The new trimmer C, mounted on S1E. The final amplifier compartment can be seen to the right.

Parts List

X10—24.4875 MHz, HC-18/U package
C40—160-pF silver mica
C27—100-pF silver mica
Two 80-pF trimmer capacitors (Arco 462 or equivalent)
270-pF, 500-volt silver mica
300-pF silver mica (270 pF in parallel with 36 pF may be used)
560-pF silver mica, 500 volt

NEW PRODUCTS

HEATHKIT HD-1422 ANTENNA NOISE BRIDGE

Heath's new HD-1422 Antenna Noise Bridge is an antenna tuning aid which helps reveal the cause of any mismatch between a station's transmitter and its antenna. A tone-modulated broadband noise signal is generated in the HD-1422 and coupled to an impedance bridge. Using the receiver as an indicator, the impedance bridge is used to measure the reactive components of the antenna's impedance. This allows each antenna to be trimmed to a favorite operating frequency. Additionally, the HD-1422 can be used to preset an antenna tuner, to tune a quarter-wave transmission line, and to measure the value of unknown capacitors and inductors.

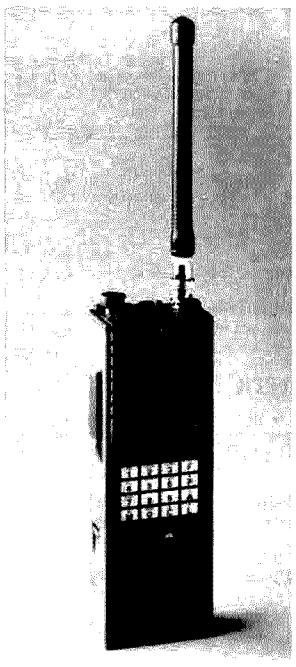
For more information about the HD-1422, get Heathkit's new catalog by writing *Heath Company, Dept. 150-592, Benton Harbor MI 49022.* In Canada, write *Heath Company, 1020 Islington Avenue, Dept. 3100, Toronto, Ontario M8Z3.*

MIDLAND LMR 16-CHANNEL HT

A new 16-channel programmable frequency-synthesized portable two-way FM radio has been introduced by Midland Land Mobile Radio. The radio features a front-panel keypad and a liquid-crystal display. VHF models cover 136-174 MHz, and UHF models cover 406-520 MHz; both VHF and UHF models have a switchable output of 5 Watts and 1 Watt.

Tone-coded squelch is a standard feature, and each channel may be separately programmed for any EIA tone. A DTMF option is also available which temporarily stores data entered from the keypad and automatically transmits it when the push-to-talk switch is activated. Other options include an external speaker/microphone with an antenna jack, a programmable scanner, and 600-mAh or 1000-mAh nickel-cadmium battery packs.

For complete details, contact *Midland LMR, Marketing Department, 1690 N. Topping, Kansas City MO 64120.*



Midland LMR's 16-channel FM portable radio.

KENWOOD TM-2570A, TM-2550A, AND TM-2530A

Trio-Kenwood Communications has announced three new 2m FM radios. The TM-25 series offers a choice of three power levels: 70 Watts with the TM-2570A, 45 Watts with the TM-2550A, and 25 Watts with the TM-2530A. The TM-2570A includes a built-in cooling fan.

All three models feature a back-lit 16-key DTMF pad, twenty-three memory channels which store frequency, offset, and subaudible access tone, and an automatic dialer which stores up to fifteen seven-digit telephone numbers.

The TM-25-series radios cover 142-149 MHz and are modifiable to cover 141-151 MHz. Available options include a 38-tone CTCSS encoder, a Digital Channel Link modem, a voice synthesizer, and a call-sign display.

Complete information is available from *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224; (213)-639-9000.*

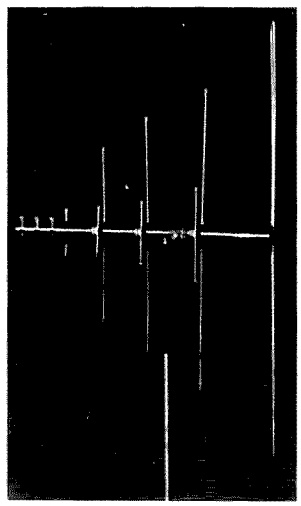
FREE TOOL CATALOG FROM CONTACT EAST

Contact East is offering a free catalog of over 5,000 hard-to-find products for assembling, installing, and repairing electronic equipment. The catalog features precision hand tools, tool kits, test instruments, soldering supplies, and static-control devices.

To request your free catalog, write or call *Contact East, PO Box 786, North Andover MA 01845; (800)-225-5370.*

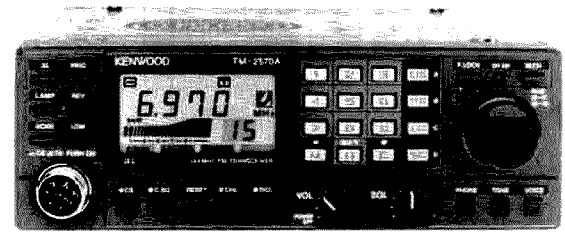
GROVE SCANNER BEAM

Grove Enterprises has introduced a new antenna for scanner enthusiasts. The Scanner Beam covers 30-960 MHz and includes a balun transformer, an offset pipe, and all necessary mounting hardware.



The Scanner Beam from Grove Enterprises.

For additional information, contact *Grove Enterprises, PO Box 98, Brasstown NC 28902; (800)-438-8155.*



Kenwood's 70-Watt TM-2570A.

VOCOM POWER AMPS

VoCom Products Corporation has introduced a new line of rack-mounted rf power amplifiers for continuous-duty applications such as repeaters or paging systems. Included in the line are models which run directly from 110/220-V-ac mains. Available output powers are 50, 100, and 200 Watts for both VHF and UHF frequencies. Ac-powered models may be configured for battery backup or automatic bypass in the event of a commercial power failure.

For further information, contact *VoCom Products Corporation, 65 East Palatine Road, Prospect Heights IL 60070; (800)-USA-MADE.*

ELECTRONIC SPECIALISTS COMPUTER PROTECTION

Electronic Specialists has introduced the Modem/Power/Static Pac, a protection device for portable computers. The unit combines a broadband ac power filter, a power spike suppressor, a modem spike suppressor and rf filter, and a static discharge plate. Filtered ac is available from both a standard 3-prong outlet and a CEE-22 universal computer power connector. Modem attachment is through modular RJ-11 connectors.

For more information, contact *Electronic Specialists, Inc., 171 South Main Street, Natick MA 01760; (800)-225-4876.*

HAMTRONICS® GaAsFET PREAMPS

Hamtronics, Inc., has announced a low-cost miniature receiver preamplifier for the VHF and UHF bands. The LNW series of preamps uses a dual-gate GaAsFET for a typical gain of 18 dB and a noise figure of 0.8 dB.

A 40-page catalog describing the LNW preamplifier line and other Hamtronics products is available from *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716)-392-9430.*

PACCOMM TNC-200

PacComm Packet Radio Systems' TNC-200 is a licensed copy of the Tucson Amateur Packet Radio (TAPR) TNC-2 terminal node controller. Available as both an assembled unit and a kit, the TNC-200 features multiple connections, a choice of NMOS or CMOS chips, and full AX.25 version 1 and 2 compatibility.

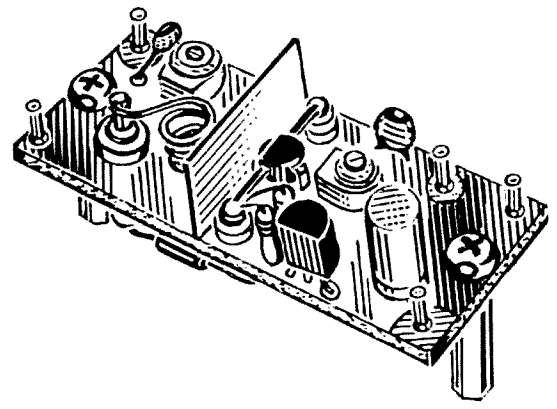
PacComm also has put together partial kits for the TNC-200 which come with hard-to-find parts, a PC board, and an assembly manual. Cabinets and end plates are offered separately.

For further details, please contact *PacComm Packet Radio Systems, Inc., 4040 West Kennedy Blvd., Suite 620, Tampa FL 33609; (813)-689-3523.*

KALGLO PLUG-IN SURGE SUPPRESSOR

Kalglo Electronics' Mini-II is a compact surge suppressor that responds in 5 nanoseconds, suppresses 13,500 pulse-Amps, and has a capacity of 135 Joules. Clamping starts at 150 volts, and its filtering circuit removes 41 dB of noise at 10 MHz in common mode and 49 dB of noise in normal mode. Once plugged into a wall outlet, the unused receptacle receives the same protection as the two outlets on the Mini-II, giving three protected sockets.

For more information, write *Kalglo Elec-*



The LNW GaAsFET preamp by Hamtronics.

tronics Company, Inc., 6584 Ruch Road, Bethlehem PA 18017-9359; (215)-837-0700.

DI-16 REMOTE DATA INTERROGATOR

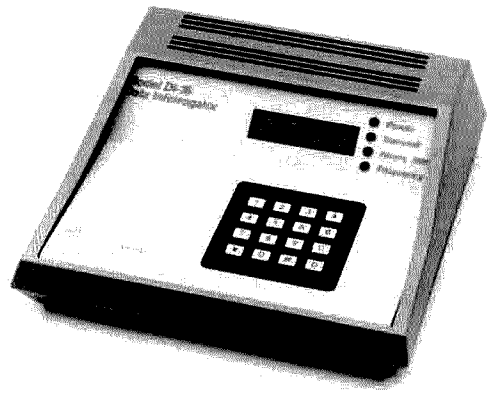
The DI-16 Data Interrogator from Communications Specialists is designed for remote retrieval of accumulated time and hit information from the TP-38 Shared Repeater Tone Panel. It also may be used to remotely access the TP-38 to enable or disable repeater subscribers. Hard-copy printout is available with a Radio Shack TP-10 serial printer, or the DI-16 may be connected to a host computer for information processing and air-time billing.

The DI-16 uses a sixteen-digit keyboard and has a high-visibility LED display. An automatic PTT keying circuit and an output port for serial communications are standard equipment.

For detailed information about the DI-16 Interrogator, contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800)-854-0547.*



The Mini-II surge suppressor from Kaigio Electronics.



Communications Specialists' DI-16 Data Interrogator.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

HOW HAMS VIEW THEMSELVES

Six years of "Fun!" polls. That's a long stretch of time, to say the least.

I remember well the day I put together the first poll. I had just finished putting a new coil in my spark transmitter when my friend Horace pulled up the driveway in his 1912 Model T.

"Hi, John!" said Horace, as he folded down the rumble seat. "How's the mobile antenna project coming along? '

"Not bad," I replied. "But you wouldn't believe how many windings have to go into a 300-meter loading coil. . .real bear to wind."

"Think it'll work?" he asked.

"In theory it should. But whenever I attach the antenna to my Locomobile's rear bumper, it lifts the car's front wheels off the ground," I grumbled.

"Tough luck, OM," said Horace, as he played with my new mobile rig's coupler.

Okay, okay, I'm exaggerating, but it *has* been a long time.

This year, as in previous "Fun!" polls, we're retaining many old questions to track developing trends in our hobby and adding some new ones to keep up with the times. Whatever your views, send your responses to PO Box 73, Middle Village NY 11379. Or, if you've given up on the US Mule, you can transmit your answers electronically. My CompuServe ID is 70007,412 (CIS) or 76004,174 (EIS). My Source ID, if you prefer that system, is CPA117. You may also contact me via MCI Mail; just type my name at the "To:" prompt.

ELEMENT 1 BACKGROUND

1) Sex:
A) Male
B) Female
2) Age:
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 years and up
3) License class:
A) Novice
B) Technician
C) General
D) Advanced
E) Extra
4) Number of years licensed:
A) 1 year or less
B) 1-5 years
C) 6-10 years
D) 11-20 years
E) 21 years and up
5) Do you have a new (post-March '78) call?
A) Yes
B) No
6) How many hours a week do you devote to amateur radio?
A) 0-1 hour
B) 2-5 hours
C) 6-10 hours
D) 11-20 hours
E) 21 hours or more
7) Which HF band do you use most?
A) 80/75 meters
B) 40 meters
C) 20 meters
D) 15 and/or 10 meters
E) Don't operate HF
8) Which VHF/UHF band do you use most?
A) 6 meters
B) 2 meters
C) 220 MHz
D) 420 MHz and/or up
E) Don't operate VHF/UHF
9) Which mode do you use most?
A) SSB
B) CW
C) FM
D) RTTY
E) Other
10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenses.)
A) 0-$250
B) $251-$500
C) $501-$1,000
D) $1,001-$2,500
E) $2,501 and up

ELEMENT 2 SOCIAL CHARACTERISTICS

11) On the whole hams are:
A) too young
B) too old
C) just the right age
12) Do you like rock music?
A) Yes
B) No
13) Politically, how would you define yourself?
A) Conservative
B) Middle-of-the-road
C) Liberal

RESPONSE FORM

Instructions: Read each question and mark your response by circling the appropriate letter next to the number of the question.

Element 1:
1) A B
2) A B C D E
3) A B C D E
4) A B C D E
5) A B
6) A B C D E
7) A B C D E
8) A B C D E
9) A B C D E
10) A B C D E

Element 2:
11) A B C
12) A B
13) A B C
14) A B
15) A B C D E
18) A B
17) A B
18) A B C D E
19) A B
20) A B

21) A B
22) A B
23) A B
24) A B

Element 3:
25) A B
26) A B
27) A B
28) A B
29) A B
30) A B
31) A B
32) A B
33) A B C D E
34) A B C D E
35) A B
36) A B
37) A B
38) A B
39) A B C D E
40) A B

41) A B
42) A B
43) A B
44) A B
45) A B C D E
46) A B C D E
47) A B C D E
48) A B C D E
49) A B
50) A B

Comments: _____

14) Should we get rid of the ARRL?
A) Yes
B) No
15) How old were you when you first became a ham?
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 or above
16) Should the FCC increase the speeds on amateur CW examinations?
A) Yes
B) No
17) Do you own a home computer?
A) Yes
B) No
18) If you answered "yes" to question 17, which brand?
A) Apple
B) IBM
C) Radio Shack
D) Commodore
E) Other
19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes
B) No
20) Are hams getting dumber?
A) Yes
B) No
21) Do business interests deserve some of our virtually abandoned bands?
A) Yes
B) No
22) Should ham licenses have a minimum age requirement?
A) Yes
B) No
23) Should ham licenses have a maximum age requirement?
A) Yes
B) No
24) Should hams be subject to periodic retesting?
A) Yes
B) No

ELEMENT 3
OPERATING HABITS

25) If the users were restricted to data communication only (no phone or CW operation), would you be in favor of a no-code 220-MHz Digital-class license?
A) Yes
B) No
26) Would you be in favor of a no-code 220-MHz Digital-class ticket if it permitted phone operation in addition to data transmission?
A) Yes
B) No
27) Have you ever used a personal computer in connection with your amateur-radio activities?
A) Yes
B) No
28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes
B) No
29) What do you think of people who view pay-television services with MDS converters and satellite dishes that are not approved by broadcasters?
A) They're skunks.
B) They're within their rights.
30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes
B) No
31) Do you think DX nets have a place in ham radio?
A) Yes
B) No
32) Do you think nets in general have a place in ham radio?
A) Yes
B) No
33) The next time a ham operates from space, which band should he/she use?
A) 2 meters
B) 220 MHz
C) 450 MHz
D) An even higher band
E) Shouldn't bother to operate
34) If, while tuning across a band, you heard a net called "Jammers International" in progress, would you:
A) Jam it
B) Ignore it
C) Complain to the FCC or some other organization
D) Listen
E) Join it
35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes
B) No
36) If required, could you pass the FCC theory test for your license class?
A) Yes
B) No
37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes
B) No
38) Are you fluent in any computer language?
A) Yes
B) No
39) If you answered "yes" to question 38, which language?
A) Basic
B) Pascal
C) Assembler
D) Machine
E) Other
40) Do you feel yourself competent to write a short Basic program?
A) Yes
B) No
41) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes
B) No
42) Do you solder together your own coax connectors?
A) Yes
B) No
43) Do you own a TVRO (home earth satellite) system?
A) Yes
B) No
44) Do you operate a packet-radio system?
A) Yes
B) No
45) What do you think of contesting?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it
46) What do you think of DXing?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it
47) What do you think of repeaters?
A) Great
B) Good
C) Okay
D) Don't like them
E) Despise them
48) What do you think of traffic handling?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it
49) If you heard an emergency net in progress, would you immediately join in and offer your services?
A) Yes
B) No
50) Have you ever secretly hoped for a minor disaster to strike your community just so you could demonstrate your radio skills?
A) Yes
B) No

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of February are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
February 1986

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2313	1	0200					217	7
2315	2	0100					208	12
2317	3	0100			224	1	202	14
2319	4	0000			216	7	192	17
2321	4	2300	222	3	207	11	182	18
2323	5	2300	217	6	201	13	175	17
2325	6	2200	208	11	191	16	165	16
2327	7	2100	198	14	181	17	155	13
2329	8	2000	188	17	170	16	145	9
2331	9	2000	181	16	164	15	140	5
2333	10	1900	171	16	154	12	132	0
2335	11	1900	165	15	148	9		
2337	12	1800	155	12	140	4		
2339	13	1700	145	8				
2341	14	1700	140	4				
2343	15	1600	133	0				
2348	18	0200					229	0
2350	19	0100					221	5
2352	20	0100					216	8
2354	21	0000					207	12
2356	21	2300					197	16
2358	22	2300			215	7	190	17
2360	23	2200	220	4	206	12	180	17
2362	24	2100	212	9	196	15	169	17
2364	25	2100	206	11	189	16	163	15
2366	26	2000	196	14	179	16	153	12
2368	27	1900	186	16	168	15	144	8
2370	28	1900	180	16	162	14	139	4

HAM HELP

I need a station monitor that is compatible with the Heath HW-101. Heath made one, but I can't remember its nomenclature. I will pay UPS charges to Hawaii.

Fred Smallwood WA4JVL
COMTHIRDFLT
Pearl Harbor HI 96860

I'm looking for a nonworking Arnco Marine VHF synthesized radio with a schematic or service manual, and a Hallicrafters 2m unit.

Gary Bernard
1025 Meadowlark
Merritt Island FL 32953

I need a manual for a VHF Engineering Synthesizer II.

Jim Patterson WB5UGZ
25 Schaetter Lane
Freehold NJ 07728

I'm looking for copies of these military manuals: NAVSHIPS 0967-173-7010 Volume 1, NAVSHIPS 92175, NAVSHIPS 93210, and MIL-R-12887.

Charles T. Huth WB8NLM
229 Melmore Street
Tiffin OH 44883

Has anyone had any experience with a program called "Morse Code in Color" from the December, 1982, issue of *80 Micro*?

Nathan Leichty
946 Knapp
Grand Rapids MI 49505

I'm looking for a schematic for a 1-C single-slot coin telephone. I will pay a reasonable price for the original or a copy.

Mel Wardean K6QXE
18193 Fisher Drive
Visalia CA 93291

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FIND OUT what else you can hear on your general-coverage transceiver or receiver. Join a shortwave radio listening club. Complete information on major North American clubs and sample newsletter, $1.00. Association of North American Radio Clubs, 1500 Bunbury Drive, Whittier CA 90601. BNB310

INDIVIDUAL PHOTOFACT FOLDERS: #1 to #1400, $3.00 postpaid. AJL, 414 Chestnut Lane, East Meadow NY 11554. BNB312

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00-3:00 pm Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

ELECTRON TUBES: receiving, transmitting, microwave all types available. Large inventory means next-day shipment in most cases. Dally Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

RADIO TRANSCRIPTION DISCS WANTED. Any size, speed. W7FIZ, Box 724—WG, Redmond WA 98073-0724. BNB347

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity discounts. Free catalog. P.G. Video Corp., 61 Gatchell St., Dept. 73, Buffalo NY 14212. BNB349

TR-7 USERS—NB-7 noise blanker, new, $65 ppd. SL-300 CW fitter, new, $50 ppd. HS-75 headset by Drake, new, $14 ppd. Tony Musero K3UKW, (215)-271-8898. BNB380

CABLE TV CONVERTERS and equipment. Plans and parts. Build or buy. Free information. C & D Electronics, PO Box 1402, Dept. 73, Hope AR 71801. BNB383

QSL CARDS: 100 for $5.00, 500 for $18.00. For a sample, send an SASE to Ken Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB388

KENWOOD 430S OWNERS! Stop 430S scanner on busy frequencies. When clear, resume automatically! Squelch-activated! Reviewed *QST* 6/85, *73* 2/85, *Worldradio* 12/84. $19.95; $29.95 assembled. $2.50 shipping. JABCO Stop Scan, R1 Box 386, Alexandria IN 46001. BNB396

SSB SQUELCH for any radio! Improved circuitry! Active filters! 2½" x 5½". $54.95 plus $2.50 shipping. JABCO Squelch-It, R1 Box 386, Alexandria IN 46001. BNB397

SOLAR-ELECTRIC MODULES. Dealer price list, $1.00. Homestead Distributing, PO Box 451, Northport WA 99157; (509)-732-6142. BNB398

SURPLUS AND MORE SURPLUS. Thousands of items, free bargain-packed flyers. ETCO Electronics, Plattsburgh NY 12901. BNB399

XEROX MEMORYWRITER—parts, assemblies, boards, manuals. Free help with service problems. W6NTH, Box 250, Benton AR 72015; (501)-776-0920. BNB404

DOCKING BOOSTERS, the most fantastic HT accessory, only $129.95! Digital-display swr meters and bar-graph power-output indicators, only $84.95! Hi-Mound keying mechanisms, most extensive line of straight keys, paddles, and mobile keys! Write for free catalogue of specialized communications products. Skywave Radio Systems, PO Box Q-1, 943 Boblett, Blaine WA 98230. BNB407

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. **SASE** for sample copy. $10.00 for one year (24 issues). PO Box 2057, Glen Ellyn IL 60138-2057. BNB412

WANTED: ICOM IC-SP2 speaker, AN/URA-17A, support brackets, and plug sets. C. T. Huth, 229 Melmore St., Tiffin OH 44883. BNB413

ANTENNA—1 New Hy-Gain TH5DXX 5-element beam in factory box, $275. 1 Wilson M204 4-element 20-meter beam, used, $150. Money order only. Loyd H. Richey WB4BMQ, Rt. 7, Box 146-A, Boaz AL 35957; (205)-593-5546. BNB414

BE OUR VALENTINE! Your unwanted equipment would be greatly appreciated by the Cupids learning English through amateur radio at Junior High School 22 on Manhattan's Lower East Side. Send it today via WB2JKJ and remember: Not only are we lovable, we're also deductable. BNB415

FOR SALE: Hickock Oscillograph, model 505A, good condition, $100. John N5HHL, 505 West Broadway, Kingfisher OK 73750; (404)-375-6473. BNB416

from page 4

the 14th of November, and the Fredericksburg "A" index jumped to a disturbed level of 22 on the 13th. Perhaps not coincidentally, there was a solar eclipse on the 12th and a solar-flux peak on the 15th. Of course there is no claim that the alignments caused the volcanism, but you do see some interesting events. The Mexican earthquake of September followed by one day a jump in the Fredericksburg "A" index to 28, and was shortly followed by a 90-degree alignment of Uranus and Mercury. . .and, by the way, it was only three days after that Hurricane Gloria began its rampage toward contact with New England.

One should bear in mind that I did not predict any of these natural disasters, but of the days between the 20th and 27th of September, I predicted propagations of Fair or Poor for six of the seven days. In November, on the four days between the 12th and 15th, I predicted Fair for two days and Poor for two days, which just happened to coincide with actual band conditions.

I think that circumstances point to the need for a closer look at these relationships and a concerted effort to attempt to rationalize them for purposes of communications efficiency and—hopefully one day in the future—for helping save lives and property.

Jim Gray

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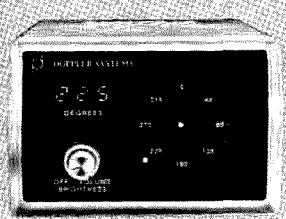
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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

TN HOMECOMING
FEB 1-2

The amateur-radio clubs of Johnson City, East Tennessee State University, and Carter County, Tennessee, will operate special-event station W4ABR on February 1-2, 1986, to celebrate "Homecoming 86" for the state of Tennessee. Frequencies will be the lower portion of all bands (including Novice) as conditions permit. Send an SASE to W4ABR, PO Box 3682 CRS, Johnson City TN 37602.

BATTLE OF KWAJALEIN AND ROI-NAMUR
FEB 1-10

The Kwajalein Amateur Radio Club will operate special-event station KX6BU from 0600 UTC on February 1, 1986, until 0600 UTC on February 10, 1986, to commemorate the 42nd anniversary of the Battle of Kwajalein and Roi-Namur. Frequencies will be: SSB—28.550, 21.350, and 14.250; CW—28.050, 21.050, 14.050, and 7.025. For $6.00, stations working KX6BU will be issued a certificate, a QSL, and a 64-page book describing the Battle of Kwajalein and Roi-Namur. $3.00 will bring a QSL and a certificate. All requests should be sent to: KX6BU, Box 444, APO San Francisco 96555-008.

PUNXSUTAWNEY PHIL
FEB 2

The Punxsutawney Amateur Radio Club will operate special-event station KA3CUY on Sunday, February 2, 1986, beginning at 9:00 am EST, to commemorate Groundhog Day 1986. Frequencies are 3.950 and 7.230 MHz ±QRM. KA3CUY will carry a recording of the official proclamation for the next 6 weeks' weather (as determined by Punxsutawney Phil). For a certificate, send a QSL and a large SASE to PARC, RD 5, Box 14, Brookville PA 15825.

LORAIN OH
FEB 2

The Northern Ohio ARS will hold its annual Winterfest on Sunday, February 2, 1986, beginning at 8:00 am, at Gargus Hall, Lorain OH. Admission is $2.00 in advance and $2.50 at the door. 8-foot tables are $7.00. Talk-in on 146.10/.70. For tickets or more information, write NOARS Winterfest, PO Box 354, Lorain OH 44052.

INVERNESS FL
FEB 8

The Sky High ARC will sponsor a ham flea market on February 8, 1986, from 9:00 am to 4:00 pm, at the Citrus County Fairgrounds auditorium, on US 41 south of Inverness FL. Admission is $1.50 in advance and $2.50 at the door. License exams will be given. Talk-in on 146.955. For more information, write SHARC Hamfest, PO Box 572, Lecanto FL 32661, or call Bob Gordon W1KUL at (904)-628-5045.

ST. CATHARINES ONT
FEB 8

The Niagara Peninsula ARC will hold its annual hamfest and flea market on Saturday, February 8, 1986, beginning at 8:00 am, at the UAW Hall, Bunting Road, St. Catharines, Ontario. Talk-in on 147.240/.840. For more information, contact NPARC, Box 692, St. Catharines, Ontario LR2 6Y3, Canada.

ORANGE NJ
FEB 9

The West Orange ARC will hold a hamfest on February 9, 1986, from 8:00 am to 4:00 pm, at the Orange Elks Club, 475 Main Street, Orange NJ. Admission is $3.00. Tables are $10.00. Talk-in on 146.55 and 224.80. For more information, call Mike at (201)-736-4611 after 5:00 pm, or call Rob at (201)-731-9506 or (201)-674-8148 any time.

MARLBORO MA
FEB 16

The Algonquin ARC will hold its annual hamfest/electronic flea market on Sunday, February 16, 1986, beginning at 10:00 am, in the Marlboro Junior High School cafeteria. Admission is $1.00. Tables are $7.50 in advance and $10.00 at the door. Seller setup begins at 8:30 am. Talk-in on .01/.61 and .52. For reservations or more information, contact the AARC, PO Box 258, Marlboro MA 01752; (617)-393-9920.

SPOONER WI
FEB 16

The Wild Rivers ARC will hold its midwinter swapfest on Sunday, February 16, 1986, from 10:00 am to 3:00 pm, at the Spooner Experimental Farm, east of Spooner WI on Highway 70. Exams will be given. Tables are available. Talk-in on 147.81/.21. For more information, contact Tom Young KD9FC, Route 5, Box 5239, Hayward WI 54843.

MANSFIELD OH
FEB 16

The Mansfield Midwinter Hamfest/Auction will be held on Sunday, February 16, 1986, beginning at 7:00 am, at the Richland County Fairgrounds, Mansfield OH. Admission is $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Talk-in on 146.34/.94 (W8WE). For tickets or more information, contact Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905; (419)-589-2415 after 3:00 pm EST.

FRIDLEY MN
FEB 22

The Robbinsdale ARC will sponsor the fifth annual Midwinter Madness Hobby Electronics Show on February 22, 1986, from 7:00 am to 2:00 pm, at Totino-Grace High School, 1350 Gardena Avenue NE, Fridley MN. Admission is $3.00 in advance and $4.00 at the door. 8-foot tables are $8.00; 1/2 tables are $4.00. Exams will be given. Talk-in on 147.60/.00 (KØLTC) and .52 simplex. For more information or to register, contact the Robbinsdale ARC, PO Box 22613, Robbinsdale MN 55422, or call Bob at (612)-533-7354.

GLASGOW KY
FEB 22

The Glasgow Swapfest will be held on Saturday, February 22, 1986, beginning at 8:00 am, at the Glasgow Flea Market Building, two miles south of Glasgow KY, just off Highway 31E. Admission is $2.00; no extra charge for exhibitors. The first table is free, and each additional table is $3.00. Talk-in on 146.34/.94. For more information, contact Mike Goad N4HCO, Route 4, Box 354, Glasgow KY 42141.

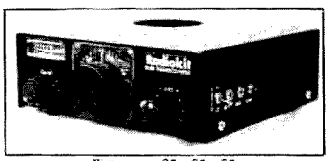
LA PORTE IN
FEB 23

The LaPorte ARC will sponsor a hamfest on Sunday, February 23, 1986, at the La Porte Civic Auditorium, La Porte IN. Admission is $3.00. Tables are $2.00 in advance and $2.50 at the door. Talk-in on .52 simplex. For more information, send an SASE to LARC, PO Box 30, La Porte IN 46350. For table reservations, mark your correspondence to the attention of KA9PHA.

DAVENPORT IA
FEB 23

The Davenport Radio Amateur Club will hold its 15th annual hamfest at the Davenport Masonic Temple, Brady Street (Highway 61) and 7th Street, Davenport IA, on Sunday, February 23, 1986, from 8:00 am to 4:00 pm. Admission is $2.00 in advance; $3.00 at the door. Tables are available by reservation for $7.00, with $2.00 extra for ac hookup. Table setup begins at 7:00 am. Talk-in on 146.28/.88 (WØBXR). For reservations, advance tickets, or more in-

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formation, contact Dave Johannsen, 2131 Myrtle Street, Davenport IA 52804.

TALLMADGE OH
FEB 23

The Cuyahoga Falls ARC will sponsor its 32nd annual Electronics Equipment Auction and Hamtest on Sunday, February 23, 1986, from 8:00 am to 3:00 pm, at Tallmadge High School, Tallmadge OH. Admission is $3.00 in advance and $4.00 at the door. 8-foot tables are $5.00 in advance (send an SASE). Talk-in on .87/.27. For tickets or more information, contact Bill Sovinsky K8JSL, 2305 24th Street, Cuyahoga Falls OH 44223; (216)-923-3830.

VIENNA VA
FEB 23

The Vienna Wireless Society will hold its annual Winterfest on February 23, 1986, beginning at 8:00 am, at the Vienna Community Center, 120 Cherry Street, Vienna VA. Admission is $4.00 (children 12 and under are free). Tailgating is $7.00 (includes one admission). Talk-in on 146.31/.91 and 147.51. For more information, contact the Vienna Wireless Society, PO Box 418, Vienna VA 22180.

CIRCLEVILLE OH
MAR 2

The Teays ARC will sponsor a hamfest on Sunday, March 2, 1986, from 8:00 am to 4:00 pm, at the K of C Building, 2489 North Court Street, Circleville OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. For tickets (send an SASE) or more information, contact Dan Grant W8UCF, 22150 Smith Hulse Road, Circlevlle OH 43113; (614)-477-3026.

CHICOPEE MA
MAR 2

The Mount Tom Amateur Repeater Association will hold its annual flea market on March 2, 1986, from 8:00 am to 3:00 pm, at the Knights of Columbus Elder Council 69, Granby Road, Chicopee MA. Admission is $1.00; ladies and children under 12 are free. Tables are $7.00 in advance and $8.00 at the door. For more information, contact MTARA, PO Box 3494, Springfield MA 01101.

WINCHESTER IN
MAR 2

The Randolph Amateur Radio Association will sponsor a hamfest on Sunday, March 2, 1986, from 8:00 am to 5:00 pm, at the Winchester National Guard Armory, Winchester IN. Admission is $3.00 (under 12 free). Spaces are $5.00 with a table and $2.50 without (available by reservation only). Talk-in on 147.90/.30 and 224.90/223.30. For reservations or more information, write RARA, PO Box 162, Winchester IN 47394, or call Jake Life W9VJX at (317)-584-9361 or Herb James WB9UZZ at (317)-584-4995.

DALTON GA
MAR 8

The Dalton ARC will hold its annual hamfest on March 8, 1986, at the North Georgia Fairgrounds, Dalton GA. Further information may be obtained from the local HF and VHF nets or by writing the Dalton ARC, PO Box 143, Dalton GA 30722-0143.

MILWAUKEE WI
MAR 8

The Milwaukee School of Engineering ARC (W9HHX) will sponsor its annual hamfest on Saturday, March 8, 1986, from 8:00 am to 2:00 pm, at 1121 North Milwaukee Street, Milwaukee WI. Tickets are $2.00 and 4-foot tables are $3.00. Talk-in on 146.19/.79 and 146.52. For more information, send an SASE to W9HHX Fest, PO Box 644, Room C-6, Milwaukee WI 53201-0644.

AUBURN NY
MAR 15

The Auburn ARA will hold its annual Winterfest on March 15, 1986, from 9:00 am to 5:00 pm, at the Farm/Home 4H Center, Grant Ave./Route 5, Auburn NY. Admission is $3.00; tables are $5.00. Testing will be available. Talk-in on 147.00. For more information, contact Robert C. Bruno WA2ITJ, 1 Birch Lane, Auburn NY 13021.

GRAYSLAKE IL
MAR 23

The Libertyville and Mundelein ARS will sponsor LAMARSFEST 86 on Sunday March 23, 1986, from 8:00 am to 2:00 pm, at the Lake County Fairgrounds, Grayslake IL. Admission is $2.00 in advance and $3.00 at the door. Tables are $5.00 each. Talk-in on 147.63/.03 and 146.52. For information or reservations, write Marc Abramson, PO Box 633D, Wheeling IL 60090.

CORRECTIONS

An error crept into Gary Sargent's "One-Chip Facsimile" project for the Atari 800 (December, 1985, page 38). Please replace Fig. 1 with the correct version shown here.

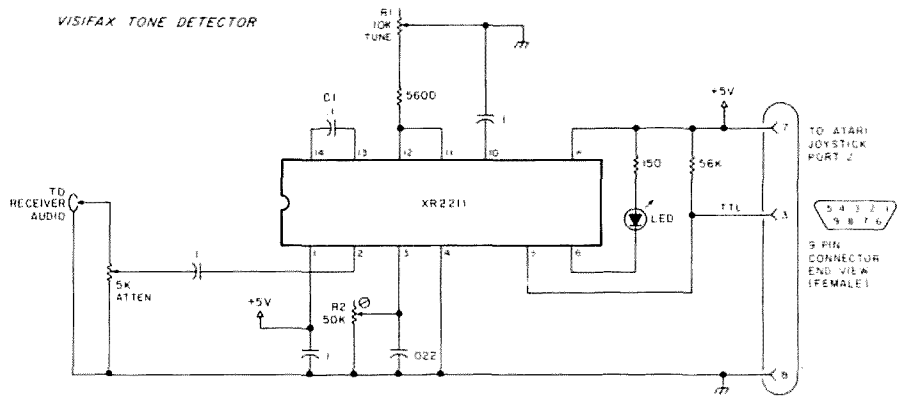
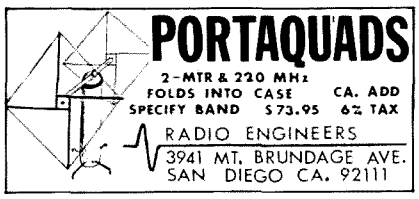


Fig. 1. Tone-detector schematic.


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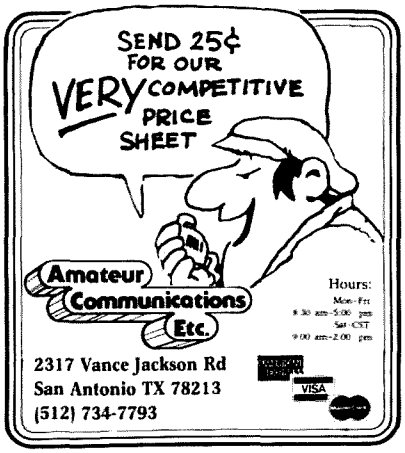
4 BAND SLOPER	160, 80, 40, 20, or 20M	60 ft long	$ 48 ppd
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2 " "	80, 40M	40 ft "	$ 35 "
3 " "	NO-TRAP DIPOLE 160, 80, 40M	113 ft long	$ 71 "
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REVIEW

AEA PK-64 PAKRATT™ DATA CONTROLLER

To borrow a phrase, the packet revolution has become a process of evolution. Mankind as we know it has evolved slowly, but it seems that new digital technologies are being implemented and improved almost overnight. The current trend in low-cost, versatile amateur equipment takes another giant leap forward with AEA's introduction of the PK-64.

At the 1985 Dayton Hamvention, the introduction of several packet-radio TNCs all but stole the show. The TAPR people were there touting the new low-cost TNC-2, Kantronics brought the Packet Communicator, and GLB and Heathkit displayed their wares. AEA stood quietly in the corner with the PKT-1 and showed off Doctor QSO™ to the delight of the convention-goers. Were those all-knowing smiles on the faces of the AEA staff?

With the public showing of AEA's PAKRATT system at the ARRL National Convention in Louisville, heads turned to see the latest developments in digital communications. What they saw was nothing short of the best thing to happen to that field since the Commodore 64 computer started selling for under $200!

New technologies require a growing period. The amateur community has been fortunate that the pioneers centered in the Tucson, Vancouver, and Washington DC areas have developed digital communication on the ham bands at virtually no cost to the amateur fraternity as a whole.

Growth in any new mode really begins when gear becomes commercially available. The PKT-1 began the movement and continues as a solid, commercial-grade TNC useable with any computer. The PK-64 applies the technology to the most favorite ham-shack machine—the Commodore 64. It does it at a price ($220) that should certainly prove to be "popular" with the ham community.

If I started telling you about all of the features of the PK-64, *73* would have to add a special section just to hold this review. The versatility and capabilities of the unit are almost overwhelming.

I can simplify much of this by suggesting that you check the back issues of *73* for my reviews of the CP-1 computer patch and MBATOR software from AEA. You see, PAKRATT not only operates packet like a champion, it gives you CW, RTTY, ASCII, and AMTOR operation all in one package! In my shack, it replaces several software packages and at least two interfaces.

The box containing the PK-64 is styled in the same fashion as the PKT-1 and CP-1. It is small in stature and is deeper than it is wide. The front panel is uncluttered. Depending on whether you have the optional high-frequency modem (HFM-64) installed, the front panel includes a DCD (data carrier detect) and PTT LED. With the HFM-64 installed, a threshold control and a tuning indicator are visible. Otherwise, just a red window and snap-in hole cover round out the front of the unit.

Emerging from the side of the PK-64 is a shielded ribbon cable designed to connect to the C-64 expansion port. That's the same one you use to plug in game and program cartridges. The familiar 5-pin connectors for radio-interfacing, audio-in, and external-speaker jacks are located on the rear panel. An external 13-volt-dc adapter is supplied and plugs into a rear connection. I had no trouble hooking the unit up to operate with several radios, including my IC-2AT.

With the PK-64 connected and everything powered up, a simple SYS command brings the unit to life. Now the real fun begins! The main menu looks similar to that of the MBATOR software package on which the PK-64 program is based. Selecting "P" for packet gets us to that mode and allows us to gain access to an options menu.

The touch of a function key brings a menu with many options up on the screen. Rather than using the traditional TAPR command mode to set many of the parameters (particularly the ones you seldom change), you need only use the cursor keys to highlight the option you wish to change. On/off functions are toggled with the return key. Numeric inputs are entered from the keyboard followed by a return. The TAPR names like CONOK for "connect OK" are used or are very close so there is no need to learn a new language.

Some of the options used in RTTY and AMTOR must be accessed through this menu as well. That's a very minor inconvenience since it requires coming back through the packet display to access them. There are only a handful of commands you will normally input through the command mode in packet. Connect and disconnect instructions are the major ones. "MY" followed by a space and your callsign sets that parameter. Incidentally, your custom settings can be saved to disk or cassette for recall at another time.

The PK-64 offers the standard beacon mode. The beacon text (BTEXT) is input via the command mode. There's also a neat feature that utilizes a message called CTEXT. That stands for "connect text." With the options set properly, your PK-64 becomes a packet answering machine. When a station connects, the PK-64 sends a message of your choosing, normally inviting the connecting station to leave a message for you and then disconnect.

Perhaps if you attended the Louisville convention you heard the sound of the "connect siren" in the PK-64. It sounds a bit like an "end of the world" alarm—guaranteed to get the attention of even the soundest sleeper.

As in other modes, both a transmit buffer and a receive buffer can be activated. The receive buffer will hold about 20,000 characters. The review and editing features of the software allow you to manipulate the received text in any form you like. You have access not only to the QSO buffer but also to 10 message buffers. Text can be moved around from one buffer to another using the special editor. Actually it's a rather complete word processor that allows editing, saving, and loading.

The path used to connect is displayed in the header of connect messages. You can elect to stamp connected and monitored packets with just the time, the day and time, or the month, day, and time.

I can't conclude the discussion of features without telling you about two of my favorites. In the packet mode, the PK-64 will keep track of the number of unacknowledged packets you have sent. I frequently work over paths that are very marginal, particularly during daylight hours. The counter keeps me instantly informed in the event the packets start backing up. There is also an on-screen oscilloscope showing mark and space tones (more of a gee-whiz feature than it is useful). A perfectly-tuned signal makes the pattern look just like it should.

I'd like to switch into overdrive for a moment and talk about using the PK-64 on HF. The unit I tested included the optional HFM-64 module. It is a modem that uses the same technology present in the CP-1 computer patch. Normally, for the AFSK signals used on VHF operations a much simpler modem will work quite well. With the reduction in signal-to-noise ratios and additional interference present on the low frequencies, such simple modems don't perform well.

I've read many accounts of high frustration levels encountered by others trying to tune packet signals on the popular 20-meter packet frequency (14.103 MHz). I've done a limited amount of work there and have found it to be much more difficult than working on VHF.

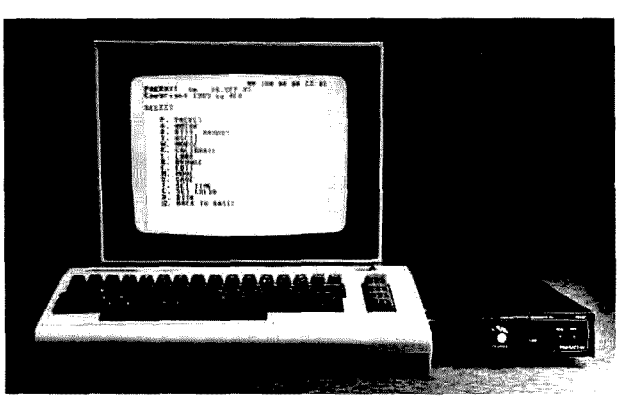
Preparing to be quite skeptical, I connected the PK-64 to an R-600 receiver—not the best or easiest radio to tune for FSK signals. A quick check of the frequency revealed packet activity and I went to work tuning it in. Just as with the CP-1, the HFM-64 module made accurate tuning of the signal quite easy. I had my first packet station tuned in and printing within 30 seconds! Appropriately, it was Hank W@RLI's bulletin board. I enjoyed many other QSOs with similar ease in tuning. The only problem I had was the "bursty" nature of the packet signal as opposed to the continuous tone from a RTTY station.

If this were all the PK-64 did, it would have to be one of the best values in amateur radio today. But you must not forget that it works equally well on CW, RTTY, ASCII, and AMTOR. With the unit hooked up to my 2AT, I particularly liked being able to operate packet and traditional RTTY from one setup. We have several RTTY mailboxes on 2 meters in addition to the packet activity. All I had to do to switch between the two modes was to go to the option menu, select HF for band (setting the modem to standard mark and space frequencies), and then go back to the main menu and select RTTY mode.

Take a good look at the PK-64. For maximum effectiveness, I highly recommend the optional HFM-64 module. Both pieces come to about $320 total amateur list. For those without a Commodore 64 and not well equipped for assembling a TAPR TNC-2 from the ground up, AEA has introduced the PK-80. *73* will keep you posted on the latest developments.

Information on the PK-64 PAKRATT system is available from *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

Jim Grubbs K9EI
Springfield IL



AEA's PK-64 PAKRATT.

CW TRAINING FOR THE APPLE

Learning Morse code has always been one of the less enjoyable steps in obtaining a ham ticket. C.W. Tutorsoft and C.W. Testmaster, written for the Apple II family of computers by Twin Oaks Associates, can make learning "the code" a rather enjoyable experience, especially if you or someone you know is one of the growing number who are attracted to amateur radio after being first exposed to the world of computers.

The user's guide and study manual supplied with the program state that C.W. Tutorsoft and its companion, C.W. Testmaster, are compatible with Apple II, II+, IIc, and IIe computers having a minimum of 48K of RAM and one disk drive. The program will also run on an Apple III computer using a pre-booted emulator. An Apple IIe system was used for this evaluation, throughout which the programs performed flawlessly. For those of you interested in the finer details of the software, these programs utilize the DAVID-DOS disk operating system licensed from David-Data, Inc., to provide fast disk access during program execution.

Written by Dr. Thomas F. Linde KZ@T, C.W. Tutorsoft is an exceptionally fine training program which trains the user by combining the audible CW tones with characters printed on the Apple's high-resolution screen as the various groups of characters are taught. This method is in contrast to the usual audio-cassette method of a "teacher" speaking the character name before and after the CW version. This visual/aural approach seems much more natural since in most cases an operator will write or type a CW message as it is received.

The program is designed to grow with the user as he/she becomes more proficient. Each program section (or Focus Menu, as the author calls them) allows the user to vary the speed and pitch of the CW while tackling various types of lessons. These menus will serve the would-be Novice or the Extra-class operator alike, offering four major areas of study: (1) the standard alphabet lessons and drills; (2) small, medium, and large or complex words to teach word recognition; (3) call-sign recognition to prepare for FCC code tests; (4) QSO phrases to help with on-the-air "conversation" and again to make the FCC exams easier. Each section allows the user to select either Novice, General, Extra, or "Good Grief!" speeds to study the code.

C.W. Tutorsoft is an ear-training program. Within each review, the user must type the received letter or phrase on the keyboard. The program ignores any response entered prior to the completion of the material being sent. In each review, the program randomly sends you the Morse-code material contained in the study section preceding it. Your task is to type what you've just heard onto the keyboard. In each review, the program scores your performance and will send you on to the next lesson if your score exceeds the passing mark.

The next step up from C.W. Tutorsoft is its companion program, C.W. Testmaster. Following much the same ear-training technique as C.W. Tutorsoft, Testmaster goes a step beyond by providing users with an opportunity to copy various random QSO-type drills. Additionally, the program provides two distinct QSO messages which the user is tested on. One is a randomly-generated message which draws 13 specific pieces of information from a data pool of appropriate possibilities. The second QSO message is programmable, allowing the user to select his/her own variables for the drill. Both of the QSO exercises are followed by a completion quiz to test the student's understanding of the material presented.

Both C.W. Tutorsoft and C.W Testmaster are well-written, well-documented programs. Each sells for $30.00, a reasonable price especially when compared to other computer-aided instruction programs for the Apple. A minor drawback attributed to the use of a customized disk operating system is the inability of making backup copies of either program. Before purchasing either program, you may want to contact the folks at Twin Oaks to check on their policy about backups. All in all, I think you will find these programs extremely useful in learning CW for the first time or preparing to upgrade to the General- or Extra-class license.

For further information on these products, contact *Twin Oaks Associates, Route 5, Box 37, Knoxville IA 50138; (515)-842-6256.*

Tim McDonough WD9EDT
Springfield IL

G.W. MORSE KEYS PEP/B CONVERSION MODULE

There are many reasons why it is more useful to be able to read peak envelope power rather than rms power on your output or incident power meter.

If you are running full legal power you need to know what your PEP is if you are to be sure you are within the 1500-Watt PEP limit. If you are running less than that it is still very useful to be able to adjust your drive or mike gain to the point where your final is just producing maximum peak power on speech. Any drive past that point is likely to result in some splatter and distortion (and wear and tear in your finals).

The movement and the needle of your forward power meter have too much inertia to be able to follow speech patterns, so the reading you normally get on speech as the needle swings up and down doesn't mean much. You can assume that if the needle bounces to about 50 Watts as you talk, you probably are producing about 100 Watts peak output. If you make a long "AHHHH" into the mike, it will probably read close to 100 Watts. But this is all guesswork. Most people seem to believe the needle should bounce to full output power as they talk—hence the large number of wide splattering signals there are around.

I have several power and swr meters built into the rig and antenna-matching units, so buying yet another meter just to be able to read PEP was not a welcome prospect. I saw an ad from Amateur Accessories (United Kingdom) for a conversion module that would convert any forward power meter to read PEP, so I sent for one. It came in a couple of weeks from G.W. Morse Keys in Wales.

The whole thing is built on a printed circuit board 2.25 inches long x 1.25 inches wide and attaches with a single mounting screw. On the board is one integrated circuit and about 20 passive components. It requires a dc input of from 3 to 15 volts (the calibration is unaffected by voltage change) and takes about 1 milliamp. The manufacturer says that three heavy-duty AA cells in series would run it for about 9 month's continuous use, or about three years if switched off when the rig is not in use.

On the board, there are two calibration resistors in series which replace the movement of the existing meter. The voltage generated across these is applied to an amplifier which charges a capacitor through a diode. A second amplifier drives the meter. The total gain is unity, with 100% negative feedback.

The installation instructions are very easy to follow, and a diagram is supplied showing how to use a DPDT switch to remove the dc input and restore the meter to normal use. I did not bother to do this, as on key-down CW or on the "lock" position for adjusting the rig, rms power and PEP are the same (so I can meausre rms anyway) and I am taking 12 volts dc from the rig.

I installed the board in a Dentron MT-3000A antenna tuner. There is a space of about 5/8 inch below the chassis, shielded from stray rf, so one hole in the chassis for mounting and one in the back to take the dc cable took only a few minutes. I just cut the existing orange lead from switch to meter in the 3000A and soldered the leads from the PEP/B to the exposed ends. This makes it easy to restore the 3000A if I want to, by just joining the orange leads together again. This kind of technique saves a lot of notes in the manual. A screening board the same size as the PCB is supplied to protect the unit from stray rf if it is installed close to rf fields. I put it on just so that I would know where it is in the future.

The preset pots for calibration were set during manufacture at halfway, and this tuned out to be almost correct for the 200-microamp meter used in the 3000A. Calibration was quite smooth and easy (you just make it read the same on key-down as it did before you dabbled). When you talk, the needle rises quickly to the peak reading and stays there. When you cease talking it decays slowly, and one tap on the mike puts it right back to peak. As far as I can see it works just as advertised.

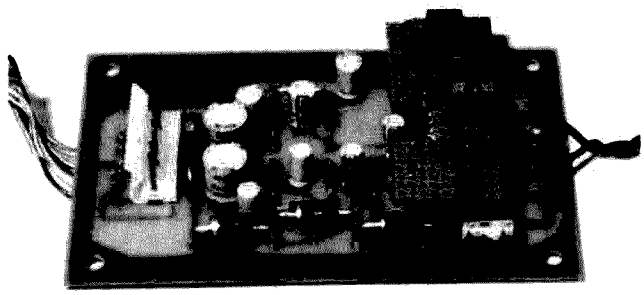
It costs 13.75 English pounds including postage and packing (US$17.00 at this time).

For more information, contact *G.W. Morse Keys, 4 Owen Close, Rhyl, Clwyd, Wales.*

Bob Eldridge VE7BS
Pemberton, British Columbia

WA1GRC TPS-1

The WA1GRC TPS-1 is a twelve-volt-dc power-supply kit for the TAPR (Tucson Amateur Packet Radio) terminal node controller and compatibles. The TNC-1 comes equipped for ac operation only via a power transformer which attaches to the TNC circuit board with a seven-pin conector. The WA1GRC TPS-1 plugs into the TNC power connector in place of the plug from the power transformer. When an 11-to-14-volt-dc power source is applied to the TPS-1, the TNC operates as usual. Using 12 volts dc, the TNC draws about 0.75 Amps.



The WA1GRC TPS-1. The perfboard assembly is a modification which is explained in the text.

The main feature that separates this dc power converter from other systems devised to power the TNC from 12 volts is that no modifications to the TNC are required. No components have to be changed and no traces have to be cut. It just plugs in.

In fact, if the TNC's five-volt regulator is mounted on the TNC's circuit board, the transformer can be removed entirely. However, if the regulator is mounted off the circuit board and wired to the transformer's connecting plug, the transformer must remain, and the connecting plug from the transformer is plugged into a connector on the TPS-1. Alternately, the regulator wiring may be disconnected from the transformer plug and wired to another plug, which is then inserted into the TPS-1 connector.

Theory

The TPS-1 contains voltage-dropping, switching, and doubling circuits. The 11-to-14-volt-dc source is dropped through four diodes to provide about 10 volts dc. The dc source is also switched through a PNP/NPN transistor pair feeding the voltage-doubling circuits to provide the +25 volts and −25 volts (maximum) needed to run the RS-232 port on the TAPR TNC. Of course, the TPS-1 output voltages will vary slightly depending on the input voltage and load characteristics.

The TPS-1 output voltages are fed to the TAPR TNC's on-board regulators to provide the regulated power necessary to operate the board.

Assembly

The WA1GRC TPS-1 was designed by Gary Field WA1GRC and is sold by him as either a complete kit or a bare circuit board. I ordered the complete kit, and it arrived by first-class mail a few days later.

The instruction manual is a few pages long and contains brief assembly instructions, a board layout diagram, and a schematic. The assembly went smoothly, however. I did notice some inconveniences with the instruction manual which, if corrected, would decrease assembly time.

Assembly depends on both the board layout diagram and the component list (which are on different pages), and I found it bothersome to flip back and forth each time I soldered a few components to the board. The resistors are referred to by value, and their color code is not mentioned; thus I had to look up the color codes to make sure I was installing them correctly. The circuit board is single-sided and does not contain markings on the component side, so care must be taken to follow the layout diagram carefully. With such a small kit these are minor annoyances, however, it would be a good idea to examine the kit carefully before beginning construction.

The components were mounted and soldered on the board, the connector was wired, and the dc power cable was attached. I was finished with assembly. A quick voltage check matched the values given in the manual, so I was sure that everything went well during assembly.

Operation

Being able to run the TNC from 12 volts dc has many advantages. Mobile operation is possible, and it can be a lot of fun to operate packet while traveling. Many repeater sites where TNCs are kept for use as digipeaters have battery backup systems, and now the TNC can take advantage of them.

In my particular situation, I planned to operate packet mobile and portable using 12-volt gel cells. I took my TAPR TNC-1, TPS-1, TRS-80 Model 100 computer, and handie-talkie along with me on vacation this past summer and was looking forward to operating packet during the trip.

I say "was" because on the first day of vacation the packet system suddenly went dead. The TNC seemed to be operating normally, but I was not able to communicate with it through the computer! Later, at the hotel, I diagnosed the problem to be with the TPS-1. One of the switching transistors had shorted out (probably due to overheating caused by poor air circulation in my restricted mobile setup) and the TNC was not getting the +25 and −25 volts it needed to run the serial communications port. As soon as I located the nearest Radio Shack, I replaced the switching transistors with higher Wattage ones in a Darlington network (see photo) and was back on the air in short order. From this experience, I can inform you that it is important to keep the TPS-1 ventilated.

Conclusion

The WA1GRC TPS-1 12-volt power converter for the TAPR TNC-1 is very useful for those desiring to operate a portable or mobile packet station. It is a pleasure to be able to operate packet independently of the ac line.

The complete kit sells for twenty dollars and the bare board sells for ten dollars. For more information, or to order, contact Gary Field WA1GRC, 5 Pluff Avenue, North Reading MA 01864.

Jonathan Mayo KR3T
Media PA

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

This month's column is prompted by several inquiries from local hams regarding the most cost-effective way to get a signal on the VHF bands. With times somewhat tight for the average amateur, this is an area of real concern for those who would like to upgrade their present HF capabilities or add more VHF/UHF bands to those already in service.

Consider the ham who purchases a working station for six meters with multimode radio, beam, and amplifier. Most likely he or she will have to shell out about $700–800 to come up with the 100-Watt station using a high-gain yagi. While this might not seem an unreasonable sum, it could very well be duplicated for each new bank added. A similar setup for 144 MHz, using a 100-Watt multimode and high-gain long-boom yagi, would come in about the same. 432 MHz would be similarly priced, and the newcomer quickly determines that the expense just isn't worth it.

But there is another solution: transverters. These magical little boxes allow the user to employ existing HF or VHF gear to access other VHF or UHF bands. If well designed, the performance is top-drawer, and all the best features of the existing HF or VHF transceiver are retained (i.e., scanning, memories, extra vfo's, SSB/CW filters, and so on).

"Well, where do I get one of these boxes?" *muses the prospective VHFer.* A glance through the current amateur mags turns up nothing—at least for those looking in the ads of the large retail outlets. All one sees is multimodes, multimodes, multimodes. Look again! There are at least four manufacturers of transverters engaged in actively selling their wares: Mutek, Ltd., and Microwave Modules, Ltd., of England, SSB Electronics of Germany, and Hamtronics of Rochester NY. There are other manufacturers of these devices, but their marketing efforts in this country are not on a level with these four. The European manufacturers sell their units as complete tested boxes—just plug 'em in and away you go. Hamtronics primarily markets their transverters as kits.

How does a transverter work? It's really quite simple: Incoming signals at the desired frequency are amplified by a MOS or GaAsFET device. These signals are then mixed with an on-board local oscillator (LO) to produce a difference frequency. This difference frequency is the LO frequency subtracted from the incoming desired VHF/UHF frequency, and it is called the i-f frequency—much as a superheterodyne receiver works. This i-f frequency is typically in the range of 28–144 MHz, depending on your needs and the converted band.

On transmit, the process works in reverse. The i-f frequency is mixed with the LO frequency to provide the desired transmit frequency. Again, MOSFETs are most commonly used in the mixer stages. Most transverters employ on-board rf power amplifiers to boost the converted transmit signal to about 10–15 Watts output. Newer models from some of the European manufacturers run more power (25 Watts), making them ideal for driving grounded-grid triode amplifiers, such as those using 8874 or 8877 tubes and even the new 3CX800 and 3CX1200 tubes.

"How much?" you ask. The answer is that you can purchase a transverter to take care of your particular band requirements for as low as $199. Now, that's a big difference from the price of the multimode mentioned before, and your performance may actually be better to boot. Consider this: A transverter is a linear device. What you put in, you get out (most of the time!). The only limitations are created by the performance of the individual devices used in the transverter, such as the MOS or GaAsFETs in the front end or the mixer devices. Still, it's an excellent way to add to your station complement without breaking the bank. And the additional savings could be towards a power amp or a mast-mounted preamp if desired.

Let's look at a typical transverter lineup. One very popular model is the Microwave Modules MMT 144-28. This unit takes 28-MHz signals and upconverts them to 144 MHz with 10 Watts of rf. Received signals at 144 MHz are downconverted to 28 MHz for reception on an HF receiver. First, transmitted signals at 28 MHz—typically 5–300 mW of drive—are fed into a dual-balanced mixer, typically employing 3N204- or 40822-type MOSFETs. Because this is a linear transverter, it doesn't matter what type of modulation is employed. The signal can be USB, LSB, AM, FM, and of course, CW. This low-level signal is mixed with the LO running at 116 MHz. The sum of these frequencies is amplified (144 MHz) in several stages, all of which are fairly tightly coupled and employ moderately high-Q tuning circuits to ensure adequate harmonic rejection. A power-amplified compartment then takes the low-level signal and amplifies in two stages to the rated 10–15 Watts output.

On receive, a 3N204 is typically used as a front-end amplifier. This device usually exhibits a noise figure (NF) at 144 MHz of about 2 dB, making it very acceptable for most VHF work. This signal is then mixed with the 116-MHz LO again and this time the difference of these frequencies (28 MHz) is amplified and fed back to the HF exciter. Tuning the band is accomplished by tuning the HF radio. In fact, these "black boxes," once tuned, can often be hidden away out of sight, as they usually require no further attention.

Similar units for 50, 432, and 1296 MHz also employ i-f frequencies of 144 MHz, to allow the person with the two-meter multimode to add another band. Again, the best features of the HF or VHF radio are retained by using transverters. Say you want to work some weak DX on 144 MHz, but a local QSO close to your frequency is causing QRM or splatter. You must switch in the SSB or CW filters on your HF rig! Try finding them on a multimode radio.

Here at KT2B, I use Microwave Modules on 144 MHz, 220 MHz, and 432 MHz—all driven by either an ICOM 740 or a Kenwood 430. On 1296, I employ an SSB Electronics LT23S transverter with an i-f of 144 MHz. Incidentally, the only multimode I use—a Kenwood TR-9000—is the "i-f" for the LT23S. This is primarily because of its scanning and fast stepped tuning, which are very useful when running up and down the band to find a QSO. Most of these units make provision for a separate antenna connection at the receiver input, allowing the use of an outboard preamp or switching through an external high-power amplifier if needed. I run mine straight through and use DPST antenna relays to bring external amplifiers in and out of the line. This is to allow QRP operation when desired.

What kind of radios can be used with a transverter? Models which have transverter provision already include Kenwood TS-520 series, 530, 820/830, 930/940, and 430. Also ICOM 730, 740, 735, 745, and 751. Many of the older Yaesu HF rigs, including the FT-101 series, made provision for an external transverter, and although the unit used tubes, the rf levels are sufficient for driving a modern-day transverter. The Collins KWM-380 has a transverter connection, and I can tell you that working 50-MHz sporadic E on a KWM-380 with a Mutek 50-MHz transverter is an experience you will not believe!

What if your radio doesn't have a transverter port? No problem. The best bet is to locate the output from the low-level rf stages before they go to the final amplifier assembly. Simply breaking this line and bringing it to a rear-panel connector, then running another line from a second connector back to the final gives you the desired connection. I employ this method on my ICOM 740 to obtain increased drive for the MMT-series modules. Jumpering the two connectors restores full HF transceive operation. On receive, use the normal antenna connector on your HF rig and connect to the 28-MHz i-f output jack on the particular transverter.

If your HF or VHF exciter runs 10 Watts or less, many of the transverter makers have 15-dB pads to drop the drive level low enough for the transmit mixer. Or, you can make one yourself out of six 2-Watt 100-Ohm carbon resistors. Connect them as shown in Fig. 1. This will dissipate most of the rf, leaving a small amount for the mixers to work with. The attenuator is generally employed with 144-MHz multimodes when converting to 50, 432, or 1296 MHz. Usually there is sufficient gain in the receiver i-f mixer to overcome the losses of this pad, especially when used in the transceive mode.

Other HF radios that could be used with this attenuator include the Ten-Tec Argonaut series, the older TS-130V, and almost any ICOM in the low-power position. Note also that all of the transverters currently available have built-in sensitivity controls to allow for a range of about 5–300 mW of drive, so you must not exceed 300 mW. When in doubt, use a pad. A 1-Watt signal padded down by 15 dB translates into about 50 mW of drive—more than adequate.

Newer modules promise increased band coverage. Microwave Modules has announced the MMT 144-28R, with GaAsFET front end and 25 Watts output power. In addition, there are two additional LO frequencies incorporated into the transverter to allow for simplex and ±600-kHz operation on FM. As presently configured, the coverage is only 144–146 MHz (the European two-meter band), but discussions with the US importer reveal plans to add a fourth LO to switch coverage up to 148 MHz to allow repeater use. Don't have a two-meter base-station rig for FM yet? One of the new transverters and the FM module for your HF radio will do the trick.

The key here is to get the maximum use from your already-purchased HF or VHF multimode radios. ICOM has announced the IC-1271 multimode for 1296 MHz, but it carries a retail price tag of *almost $1000!* For half the cost, a transverter could be bought that would do much the same thing.

An interesting development is the production of a 220-MHz transverter by SSB Electronics of Germany for the US market. This is not an allocation in Europe, so such a device is a bit of a gamble on the part of the folks from Iserlohn! Of course, Transverters Unlimited of Canada already markets such a device, based on the Microwave Modules design. For those who prefer to roll their own, Hamtronics of Rochester NY markets a full line of transverters for 50, 144, 220, and 432 MHz including a model that permits 28–30-MHz

SOURCES FOR TRANSVERTERS

Microwave Modules

The PX Shack
52 Stonewyck Drive
Belle Mead NJ 08502
(201)-874-6013

MMT transverters, converters, amplifiers

Transverters Unlimited
PO Box 6286
Station A
Toronto, Ontario, Canada M5W 1P3
(416)-759-5562

MMT transverters, converters, amplifiers

Mutek, Ltd., and SSB Electronics

The VHF Shop
16 South Mountain Boulevard
Mountaintop PA 18707
(800)-HAM-7373
(717)-474-9399

Transverters, converters, preamps, amplifiers

Spectrum International, Inc.
PO Box 1084S
Concord MA 01742

MMT transverters, converters, amplifiers

Hamtronics, Inc.

Hamtronics Corporation
65-D Moul Road
Hilton NY 14468
(716)-392-9430

Transmitting and receiving converters, preamps, amplifiers

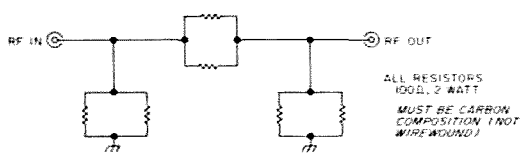


Fig. 1. A simple attenuator for padding down 10-Watt exciters to drive transverters.

operation from a 144-MHz i-f! The units are sold separately as a transmit converter and receive converter. A typical VHF transverter would cost about $120, based on the latest ads.

I often hear rumors that the big three in Japan (ICOM, Kenwood, and Yaesu) are planning to come out with transverters for the US market. These rumors would tend to be substantiated by the "transverter" accessory sockets and connectors found on many of these rigs. As of yet, I haven't seen a single one, but I can guarantee that if sales of the European and North American transverters increase by a sizeable amount, we'll have plenty of products to choose from in short order. Incidentally, I mentioned the Yaesu transverters for the FT-101 series; Kenwood also marketed transverters for 144 and 50 MHz for use with the TS-520S series. They make serviceable units if you can locate them at flea markets and hamfests. But for now, nothing from Japan.

If you feel so inclined, you can obtain a couple of B&W coax switches and select up to six transverters using 28-MHz i-fs! This is similar to a system I employ here, where 3 different bands are selected independently for the TS-430S. It makes rapid QSYing for prearranged schedules a real pleasure. And as was mentioned earlier, you can hide the boxes away if needed, to save on shelf space. All they require is 13.8 volts dc and some sort of keying line, unless you use the internal rf-sensed keying that many provide. The SSB Electronics LT23S provides an on-board attenuator to allow direct drive from a 10-Watt multimode 144-MHz transceiver.

What's coming down the pike? High-performance transverters for 50 through 2304 MHz, using GaAsFETs and diode mixers to improve dynamic range and noise figure. Transverters will be available for the new 902-MHz band shortly as well. Bandswitched crystal LOs will allow full coverage of the desired band, and of course, all-mode operation is possible on any band. I'll be reviewing some of these new models as they appear on the US shores. Look for reviews of the MMT 144-28R shortly.

Mailbox Department

This month we hear from Australia in the person of Roger Harrison VK2ZTB who is the editor of *Australian Electronics Monthly*, a slick general-interest publication not unlike *Popular Electronics* here. Roger tells of his interest in forecasting sporadic-E propagation on six meters and two meters and is very interested in the study published by Sid Lieberman WA2FXB which I mentioned several months ago. It would seem that there has been a surge in interest in this topic down under, and Roger has many clever observations pertaining to sporadic-E propagation. One in particular pertains to antenna stacking when working "scatter waves" (as he refers to them). Based on observations he and Rod VK2BQJ made, the optimum performance obtained with stacked 50-MHz yagis—working primarily sporadic E—was with the two beams 10 feet apart, or about ½ wavelength. Roger further observes that "antennas stacked one wavelength apart can often act to cancel scatter signals much of the time, as stacking for maximum plane-wave gain results in gain degradation for scatter signals."

Roger publishes the *6-UP* newsletter which contains much useful information about Aussie activities on the VHF and UHF bands, as well as several practical circuits for construction. A design for a five-element 50-MHz beam is also featured. It makes for good reading and I hope Roger will continue to forward issues from time to time. One last story which caught my eye was the attempt by Don Richards VK2BXN to work auroral scatter from the Antarctic during a scientific expedition. Apparently Don was to pursue a course that would take him under the auroral curtain, so he had the unique experience of trying to work both conventional back-scatter and front-scatter! Although Don was equipped with 100 Watts and a single yagi, he made no contacts with stations back in Tasmania and southern Australia but did hear faint CW signals at one of the appointed times.

Incidentally, the ship on which Don made his voyage was the *Dick Smith Explorer*, which I assume was the ship destined to tow an iceberg into Sydney Harbor some years back. What will those folks from VK-land think of next?

Until next month, see you Above and Beyond.

LETTERS

VITALLY IMPORTANT

I must strongly disagree with the opinion expressed by William Itter N9EWA in the November, 1985, "Letters" column. Though it is not the main thrust of his letter, Itter implies that the Novice-class license is essentially worthless, not only in its technical expertise, but in its privileges.

From personal experience I can say that one reason many people shy away from amateur radio is their fear of a long and involved test of radio theory. The Novice license serves as a relatively painless entry point to expose the newcomer to the exciting possibilities of amateur radio. Since the technical requirements of the Novice license are slight, the Novice should not expect to earn a wealth of privileges. By design, the privileges *are* limited. The idea is that once the Novice has had a taste of what ham radio is and has discovered how much more there is to do in this incredibly flexible hobby, he or she will be motivated to stay involved long enough to upgrade.

I agree that "an increase in our ranks is not going to come from either fewer restrictions or greater privileges," but the question of privileges is essentially irrelevant to enticing the newcomer to amateur radio. However, since amateur radio is continually changing, the privileges granted Novices should be periodically reviewed.

Another point Mr. Itter makes concerns the involvement of young children with computers. Most kids who become interested in ham radio get their start through the Novice license. Children as young as five have passed the exam. I wonder how many children would be turned away from ham radio by the elimination of the Novice license? How many five-year-olds do you know who could pass the Technician test?

Various radio journals have expressed their concern about the rising average age of the ham population. Do we want to aggravate this problem? We must realize that there is no exam to take before you use a computer. Computers are fascinating to children, who are exposed to them both at home and at school. But amateur radio is just as fascinating! Our problem is that we lack exposure. We need to work together to resolve this problem.

So, if we want lasting growth, maybe we should organize and pressure ham manufacturers to donate or discount radio gear to schools and youth groups. Of course, this would be pointless without the support of the amateur-radio community to develop and run the programs and clubs that would be needed. What good is a donated radio if it sits in a closet because nobody knows how to use it? Further, we must not elevate the entrance-level exam beyond the capabilities of young children. The Novice license is vitally important to the hobby.

J. Bruce Tinkler N9FJQ
Barrington IL

FINE WORK!

Regarding the Nuller Bridge by Bill Vissers K4KI ("Wheatstones Are Not Crackers!", September, 1985): Fine work! The little gadget works perfectly and costs only a few dollars to build. I've made three of them so far, the last one combined with a 50-Ohm, 100-Watt dummy load. The bridge is excellent, as there is *no* rf being radiated while resonating the antenna or tuning the transmitter.

Barrie Coates VE7AQK
Peachland BC

GOOD OLD DAYS

About your answer to KK2W's letter in the November, 1985, issue. It's interesting that you and he have apparently divergent views about the Novice license and privileges—and that neither of you is right.

Want to know what's right? Maybe I'll tell you, but first I'll tell you the way things were in 1950. The Novice program was still new. As I recall, there were three license levels, four if you count the Technicians: Novice, Technician, General, and Advanced. (I'm omitting the Conditional license.) The Novice license was good for one year and was nonrenewable, the others good for five years and renewable.

You couldn't be a Novice for more than a year, and you couldn't be an Advanced until you had been a General for at least a year. I don't think there was a 20-wpm Extra ticket until 1951 or 1952. Novices had only CW privileges on 80m and maybe phone on 2m. The 15m band wasn't available to anyone yet. Generals had all bands for CW and phone on 10m, while Advanced licensees got it all.

What in Maxim's name is wrong with that system? Nothing that I can see. The Novices had incentive and the Generals had apprenticeship. I think that all the talk about incentive licensing wouldn't be necessary if that licensing structure had been maintained.

A. J. Massa W5VSR
New Orleans LA

One of the worst things the FCC has ever done to ham radio was when they made the Novice license renewable. How many "career Novices" do you think are in the ranks now? And how many will there be after the "super Novice" ticket is available? Seems to me that the renewable Novice license is an invitation to stagnation.—KW1O.

59 – 20 dB

"Improve Your Audio Report" (November, 1985) is good advice. Jim W2OZH has done an outstanding job analyzing and documenting the need for good audio and a better reporting system. His message is 599 (QRI 10).

However, amateur radio is still a process of establishing communications links in a variety of modes and media, not just high-power audio on the rag-chewer's bands. If RST is out of date, then so are Q signals. Three digits of RST are bad enough, let alone 5 digits of QRI! Let's leave RST to QRP and let's get good audio by the use of technology (better equipment, microphones, and level control).

Since when is hi-fi audio needed on ham radio? Better we concentrate on what to say and how to say it. Most of our commercial equipment will get the message through QRM and QRN.

When I'm on phone I can say, "Your audio is clear and understandable and pleasant to hear. How do I sound?" And you can bet he'll tell me *in detail* what is wrong with my audio! Then there are those contests where everyone is 59 unless you can't hear them.

Bravo, Jim, but I'll wait for some other suggestion that can beat your QRI.

Staff Stafford NJ8F
Delaware OH

Q & A

December, 1985's "QRX" column talks about "The Final Exam" series by Dick Bash. Now that the ARRL includes FCC questions *and* answers in their study guides, I hope that you will refer to the League as "infamous" as well or you will be guilty of the worst kind of discrimination!

Clyde Grubbs WBØTYR
Jamestown ND

Dick Bash asked hams to write down questions and answers from the exam as they walked out of the testing room; his "study guides" were simply verbatim copies of the FCC exam. In fact, Dick advised examinees to ignore the warning printed on their test—the warning that said, "An attempt...to copy or divulge examination questions is a violation of FCC rules for which penalties are provided."

Under the new testing structure, all of the questions for each element are in the public domain. Since there are several hundred potential questions for each exam, it's virtually impossible to memorize enough material to pass a test. The League (and others) publishes study guides with answers to help an applicant understand the information he or she needs to upgrade; this is totally different from the verbatim regurgitation of answers by Bash's graduates.

Clyde, you mentioned that you teach a Novice class every fall. Let me ask you this: Do your students pass their exams because they understand the subject or because they've memorized twenty answers?—KW1O.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Well, I do get taken aback once in a while, and a phone call I recently received did just that. Frank Fox WA6KGD telephoned me to indicate that the news of the death of Super-RATT was a bit premature. It seems that he has assumed the distribution of this program, written for the Apple II, II+, IIe, and IIc. It requires 48K of RAM and one disk drive and interfaces with an outboard terminal unit and AFSK generator using TTL-level signals. He tells me that the program is available for $79 from him at 186 Isabella Street, Hayward, California 94544. If you like, you may reach him by telephone at (415)-538-7832 after 5:00 pm California time, and on weekends. Do I have to remind you to tell him you saw it here? I thought not!

Now, the planned RTTY computer this month is the Radio Shack Color Computer®, also known as the TRS-80C or the CoCo. This little gem of a computer has caught the eye of many a ham, both for its economy (I have seen the 16K model selling for less than $90 at my local store) and for the ease of programming the 6809 CPU.

Unfortunately, this ease of use, economy, and convenience is not matched with a plethora of RTTY programs. In fact, only two commercial programs were mentioned in all of your input.

Kantronics, which produces a version of their Hamsoft program for most of the popular microcomputers, markets a ROM-cartridge version for the CoCo. One of you wrote with some observations: "Operationally, it requires TTL signals, not RS-232. I had no trouble connecting it to my [terminal unit] and [transceiver]. It has a built-in parallel printer port, but no documentation on using it outside of the program. [The] documentation is only adequate; no schematic [is supplied]. Supports CW from 5 to 99 wpm, RTTY speeds from 60 through 132, ASCII from 110 to 300 baud. There are a number of useful configuration/operating options, 10 loadable/editable message buffers, and a type-ahead buffer. It runs with a 4-way split screen on a normal 32×16 CoCo screen. On the good side, it does work. I found no bugs, per se. The above features are nice.

"Many 'little things,' though, add up to a poor implementation of a good idea. The time-of-day clock loses about 1 minute in 8 hours. The control functions on the keyboard are easy to remember, but impossible to type one-handed (like <CLEAR><S>). There is no 'quick-load' message buffer for use during QSOs. You cannot clear the type-ahead buffer. The system is much too susceptible to noise. Even low-level QRN makes the CW-receive function useless. RTTY seems a little better, but still less noise immune than seems right for a CoCo. The receive CW speed must be calculated only on dit time; sending at the receive speed is almost always too fast. The CW algorithm lacks stability. With ORN it will jump from 18 to 88 wpm in one character time—one QRN 'pop' wipes out two characters, usually.

"I needed a program, so I am glad I have it, but I know I'll be writing one of my own as soon as I have the time." Ah, yes, the time; don't we all wish we had it!

Contrast that firmware product with another one that is far and away the most popular choice, a program marketed by our old friend Clay Abrams called NEWRTYCW. This program, written by Mike Meeks WA4VEF, is a machine-language program which features transceive operation in CW, RTTY, and ASCII. Four "station buffers" are maintained, each one 254 bytes in length. These can be loaded at the beginning of a session. There are two large buffers, a "keyboard" buffer and a "receive" buffer, both of which are 12K in a 32K CoCo. These buffers can be typed into or printed out on the station printer, as the need dictates. Full ranges of CW and RTTY speeds are supported, and the program interfaces through the "bit-banger" RS-232 port on the back of the CoCo.

This versatile piece of software is available from Clay Abrams Software, 1758 Comstock Lane, San Jose, California 95124. While I don't have a current price, I am sure that Clay would be glad to help you.

Now, there are a few problems. Unlike every other computer program mentioned here to date, this one seems to cause the hacker instinct to emerge. NEWRTYCW is supplied on tape only, and Clay tells me that there are no plans to release a disk version. Although transferring the tape program to disk does not allow disk I/O or other disk-based advantages, it does promote faster, more convenient loading with less chance of a load error. To that end, many—no, most of you—who wrote with your praises of the program included your own scheme for transferring this self-booting copy-protected program to disk.

I wrote to Clay and asked him if he minded my publishing such a scheme, and he said that he did not mind, but that he could not, of course, endorse or support such a patched program. So, if you have purchased a copy of NEWRTYCW, read on.

Of all the schemes I looked at, the best is to offset-load the program, defeating the auto-boot, and then move it back where it belongs for use. The most elegant of these is shown in Program listing 1. Submitted by Rick Koch WB1BRR of Derry, New Hampshire, it is a short loader routine appended to the front of NEWRTYCW. The modified program may be SAVEMed to disk, from which it can be LOADMed and EXECed without problem.

```
2077    1A 50     ORCC #$50
2079    8E 208E   LDX  #$208E
207C  108E 0109   LDY  #$0109
2080    EC 81     LDD  X++
2082    ED A1     STD  Y++
2084    8C 3F04   CMPX #$3F04
2087    23 F7     BLS  $2080
2089    1C AF     ANDC #$AF
208B    7E 0109   JMP  $0109
```

Program listing 1.

While Program listing 1 is the assembly version of the loader, a more practical solution for many users will be Program listing 2. This Basic program will, when run, put the loader in memory at the correct location. To use this scheme, enter the program and save it to disk as PATCH.BAS. Then put the tape with NEWRTYCW in the recorder. Type RUN"PATCH and when the OK prompt comes back, type CLOADM "NEWRTYCW",&H1F85. The tape will load, and you will get another OK. At that point, type SAVEM"RTTY",&H2077, &H3F04,&H2077 and you will be all set. Now, to go onto RTTY, just type LOADM"RTTY and EXEC the program.

```
10 ' PATCH.BAS
20 ' RTTY.LOOP  FEB 86
30 ' MARC I. LEAVEY, M.D.
40 ' THANKS TO RICK KOCH  WB1BRR
50 PCLEAR 8
60 M=&H2077
70 READ D$
80 IF D$="END" THEN END
90 POKE M,VAL("&H"+D$)
100 M=M+&H1
110 GOTO 70
120 DATA 1A,50,8E,20,8E,10,8E
130 DATA 01,09,EC,81,ED,A1,8C
140 DATA 3F,04,23,F7,1C,AF
150 DATA 7E,01,09
160 DATA END
```

Program listing 2.

My thanks to Rick Koch, Ernie Marquez KP4EIH, Rob Rochelle WA4DAZ, George Fundis KD4RC, Calvin McCarthy VE3LMP, Fred Wood WB3JKC, Gary Bender, and, of course, Clay Abrams K6AEP, along with the many others who expressed an interest in RTTY on the CoCo.

The shack of the month this month is a bit unusual. Instead of showing a shack with a ham sitting there, this is really a ham *in* his shack! Clay Abrams sent along the photo of his new computer shack, with quite a display on the screen! I'll say this, Clay, it is different!

The Pittsburg (Kansas) Repeater Organization, Inc., graced my mailbox with their bulletin, *The Procrastinator*, this month. Looks like an active group out there, with a repeater on 146.94 MHz and all kinds of functions. Of RTTY note in this bulletin is another version of the increasingly popular AFSK generator based on the XR-2206 function generator. Hams in the Pittsburg area may wish to listen to .34/.94, or contact PRO, Inc., at Box 1303, Pittsburg, Kansas 66762.

Is packet a part of RTTY, or is it a separate interest? I ask because I have been checking into HAMNET on CompuServe lately, and much, if not all, of the discussion there in the RTTY/AMTOR/Packet section is on the growing topic of packet radio. A buddy of mine has demonstrated just what can be done with packet, and I am impressed. Other than a short tutorial presented here a few months back, though, I have not covered much in that camp. Let me know what you think, yea or nay, for future coverage of this new topic.



Shack of the month: K6AEP.

Interested in copying commercial RTTY stations? Joerg Klingenfuss has brought out the fourth edition of his *Guide to Utility Stations* which is about ten percent bigger than last year's! He's even including VLF and LF stations now, plus meteorological FAX stations, and more. The guide sells for DM60 (you're on your own for conversion to dollars) and is available from Klingenfuss Publications, Hagenloher Str. 14, D-7400 Tuebingen, Federal Republic of Germany. You know whose name to drop, right?

A few months ago I mentioned the new CoCo keyboard that was appearing in stores. Selling for $4.95, this little wonder sports four keys not on the original CoCo keyboard: CTRL, ALT, F1, and F2. I wondered out loud about some software to put these keys to use. Well, another old friend, Bob Rosen, mentions that Spectrum Projects, PO Box 21272, 93-15 86th Drive, Woodhaven NY 11421, is selling a program that allows these four keys to add a 9600-baud POKE, text-screen dump, LIST command, and cold start. The CoCo keyboard enhancer is supplied on disk for $14.95.

Response on the reprint series has been most gratifying, with many of you passing along individual stories of how some of the information supplied has helped you to get on RTTY. If you would like a list of reprints available, each of which is extracted and updated from material published in this column over the past nine years, send a self-addressed, stamped envelope to me at the above address. Each reprint is $2.00, in case you are curious, but send for the list first, OK?

Don't be shy about including other comments or questions when you ask for the reprint list. I read every one and try to answer as quickly as I can. Quite a few of you have found that answers to questions submitted on CompuServe have appeared on the same day the question was sent! Mail to the above address, or EasyPlex to ppn 75036,2501. I look forward to your comments, questions, and information.

Many of your questions about specific pieces of commercial RTTY gear have been forwarded to the respective manufacturers of the equipment, but the responses have been slow in coming. I don't know if any of them read this column, which clearly is one of the longest (*the* longest?) running RTTY columns, but feedback from them is nil, folks. I can only print what information I receive, so if I am not saying much about a converter, node controller, computer, or whatever, it is *not* because I am biased or ignoring that line; it's because I have no information.

Information to share? Well, there certainly will be some next month. I know because I see some of it sitting on the clipboard already. If you want to see what it is going to be, don't miss the next edition of "RTTY Loop."

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" x 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye," and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

Help! I've been searching everywhere for information on how to do a "fast-scan" modification to my ICOM IC-02AT. Can anybody help me?

Michael Gasser KA8WPC
7630 Reitz Rd. #144A
Perrysburg OH 43551

I am looking for a Kenwood DG-5 digital display for my TS-520SE.

Mike Weir
310 Niska Rd. #104
Downsview, Ontario
M3N 2S3 Canada

I would like to obtain a copy of the review of the Realistic DX-400 shortwave receiver which appeared in the *1984 World Radio and TV Handbook*, as well as a review of the ICOM R-70 which appeared in the same issue. Also, does anyone have information on broadbanding the ICOM IC-280?

Scott Harvey
N. 5011 Idaho Rd.
Newman Lake WA 99025

I would like to borrow a copy of the manual or the schematic for a Clegg 22'er Mark II. Has anyone converted this unit for FM?

Greg Magarie WA1VIL
33 Barnesdale Road
Natick MA 01760

I need a TA-7153-P 14-pin integrated circuit to repair my receiver. I have been told that this part is used in many Toshiba television sets. Can anyone help me?

H. Marhoff
36 980 7th St. NW
Largo FL 33540

Has anyone come up with a Commodore 64 peripheral that produces SSTV graphics and text? Also, I need a schematic for a Gonset G-50 6m rig. I will gladly pay shipping and copying costs.

Kenneth Johnson WA4TOP
8 Fairview Drive North
Sun Air
Haines City FL 33844

I would like to get in touch with anyone who uses a Timex 2000 or a Timex 2068 microcomputer to exchange ideas and programs.

Manos Darkadakis SV1IW
Box 23051-112
10 Athens, Greece

I need a service manual or an operations manual for an Allied Communications model A-2515 receiver. I'll pay shipping and copying costs.

Wendell Titmus
32115 Hays Road
Warren MI 48093

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RG8U 97% shield 11 ga (equiv. Belden 8214)	31¢/ft.
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CONTESTS

Robert Baker WB2GFE
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Atco NJ 08004

VERMONT QSO PARTY
Starts: 0001 UTC February 1
Ends: 2400 UTC February 2

Sponsored by the Central Vermont Amateur Radio Club (W1BD). Each station may be contacted once on each band and mode (CW, phone, RTTY). CW and RTTY contacts must be in the CW and RTTY subbands. Duplicate and repeater contacts are invalid.

EXCHANGE:

RS(T) and state, province, ARRL country, or two-letter designator for VT county (AD, BN, CA, CN, EX, FN, GI, LA, OG, OL, RU, WA, WM, WR).

FREQUENCIES:

Phone—3.910, 7.230, 14.260, 14.320, 21.360, 28.570, 50.110, 144.2. CW—3.540, 3.720, 7.040, 7.120, 14.040, 21.040, 21.140, 28.040. RTTY—3.620 and 90 kHz from lower edge of other RTTY subbands.

SCORING:

Score one point per phone contact, 5 points per CW or RTTY contact. VT stations multiply QSO points by sum of VT counties, states, Canadian provinces, and ARRL countries (exclude US/Canada). Others multiply QSO points by the number of VT counties (14 maximum). Add 20 bonus points for working W1BD.

AWARDS:

For non-VT stations, certificate to highest-scoring station in each state, province, and country. Certificates will be given to each VT station submitting a log. A plaque will go to the highest-scoring VT station. W/VT Award given to stations working 13 of Vermont's 14 counties.

ENTRIES:

Send SASE for official log and score sheets. Send logs/facsimiles, name, class of license, and address—not later than March 1, 1986, to: D. Loverin WA1PDN, 50 Liberty Street, Montpelier VT 05602. Include an SASE for a copy of the results.

NORTH CAROLINA QSO PARTY
Starts: 1400 UTC February 1
Ends: 0500 UTC February 2

The North Carolina QSO Party is sponsored by the Alamance ARC. Work stations once per band and mode (CW and phone). Work mobiles as they change counties.

EXCHANGE:

Signal report and ARRL section (county for NC stations).

FREQUENCIES:

CW—3.525, 3.725, 7.025, 7.125, 14.025, 21.025, 21.125. Phone—3.890, 7.290, 14.290, 21.275.

SCORING:

Count one point per phone QSO; two points per CW QSO. NC stations multiply by total NC counties worked. NC mobiles may add 500 points to their score for each county outside their home county in which they make 15 QSOs.

AWARDS:

Certificates will be awarded to the highest-scoring non-NC entry, highest-scoring NC stationary entry, and highest-scoring NC mobile entry.

ENTRIES:

Mail logs by March 1, 1986, to: North Carolina QSO Party, c/o K4EG, PO Box 3064, Burlington NC 27215.

NEW HAMPSHIRE QSO PARTY
1900 UTC February 1 to 0700 UTC February 2
1400 UTC February 2 to 0200 UTC February 3

Sponsored by the NH Amateur Radio Association. Stations may be worked once per band and mode. NH stations may work each other.

EXCHANGE:

Send RS(T) and ARRL section/country or NH county as appropriate.

FREQUENCIES:

Phone—1.875, 3.975, 7.235, 14.280, 21.380, 28.580, 50.115, 144.205. CW—1.810, 3.555, 7.055, 14.055, 21.055, 28.055. Novice—3.730, 7.130, 21.130, 28.130.

SCORING:

NH stations score 1 point per QSO, multiplied by the sum of NH counties, ARRL sections, and DXCC countries worked (excluding NH, US, Canada, and DXCC countries within ARRL sections). Others score 5 points per NH QSO times the number of NH counties worked (10 maximum). In addition, all stations count 20 bonus points each for working the following NHARA member club stations: N1BYQ, WB1CAG, WB1FFZ, KB1HJ, W1OC, K1RD, W1WQM, and K0UNJ for a maximum of 160 bonus points.

AWARDS:

Certificates to highest scorer with a minimum of 5 QSOs in each NH county, ARRL section, and DXCC country. Plaque to the highest scorer in NH courtesy of Concord Brasspounders. A Worked All NH Award, sponsored by W1JB, will go to participants who work all 10 NH counties.

ENTRIES:

Send your entry no later than March 25, 1986, to Mount Moriah Repeater Association, c/o Bud Valcourt N1BYQ, 19 Teague Drive, Salem NH 03079. Include a large SASE for a copy of the results.

YL-ISSB QSO PARTY—PHONE
Starts: 0001 UTC February 8
Ends: 2359 UTC February 9

The QSO Party is open to all but emphasis is on member participation and member-to-member contacts. Operating categories include: single operator, DX-W/K partners, and YL-OM teams. All US General phone bands will be used. VHF and UHF may be used but all contacts must be direct and not through repeaters. Nets are not allowed!

EXCHANGE:

Signal report, state/province or country, name, ISSB number (if member), and DX-W/K partner's call. If no partner, leave blank. If nonmember, send "no number."

FREQUENCIES:

On HF use the USA General-class band portions. On 20 meters be aware of the nets on 14.313, 14.336, etc. Stay away from 14.332; leave it open for DX members trying to make contacts. Check 80 and 40 meters on the hour. VHF and UHF use simplex only.

SCORING:

Score 3 points for each two-way member contact on own continent, 6 points if different continent. Nonmember contacts count *one* point. Only member-station contacts count for multipliers. Multipliers are each US, VK, ZL, and VE state or province and each DX country. Also, each DX-W/K or YL-OM team contacted, but only once for each team. When DX-W/K partners contact each other it counts as a double multiplier. If your total dc input power is 250 Watts or less during the entire QSO Party, then count an additional power multiplier of *two*. Final score is sum of QSO points times the total multiplier.

AWARDS:

Special certificates will be awarded to the overall winners of each category. Regular certificates for DX country, US state, and Canadian province winners.

CALENDAR

Feb 1-2	North Carolina QSO Party
Feb 1-2	Vermont QSO Party
Feb 1-3	New Hampshire QSO Party
Feb 8-9	Dutch PACC Contest
Feb 8-9	YL-ISSB QSO Party—Phone
Feb 15-16	ARRL International DX Contest—CW
Feb 22	RTTY World Championship Contest
Feb 22-23	Alabama QSO Party
Mar 1-2	ARRL International DX Contest—Phone
Mar 9-10	Wisconsin QSO Party
Mar 15-16	YL-ISSB QSO Party—CW
Mar 15-16	Bermuda Amateur Radio Contest
Apr 12-13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
Jun 7-8	ARRL VHF QSO Party
Jun 28-29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12-13	IARU Radiosport Championship
Aug 2-3	ARRL UHF Contest
Aug 16-17	New Jersey QSO Party
Sep 13-14	ARRL VHF QSO Party

RESULTS

WINNERS OF THE 1985 BERMUDA AMATEUR RADIO CONTEST

West Germany	DF9ZP	137,750
United Kingdom	G4BWB	276,070
United States	K2UR	137,020
Canada	VE1NG	117,480
Bermuda	VP9HK	1,314,135

ARA SQUELCH TAIL

NEWSLETTER OF THE MONTH

February's award-winning publication is the Arizona Repeater Association's *Squelch Tail*, edited by Betty Kaiser WA6HRX. The *Tail* is mechanically one of the best newsletters we have seen in a long time. Of course, good looks aren't the only thing that the *Squelch Tail* has going for it! Betty and her staff fill its pages with interesting news clips and feature articles, drawing from sources such as *Westlink* and the *ARRL Letter*.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to 73 Magazine, Editorial Offices, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

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ENTRIES:

Logs must show usual contact info plus ISSB numbers and QTHs. Mail entries before April 30, 1986, to Bill Early WA9AEA, PO Box 401, McHenry IL 60050-0401.

DUTCH PACC CONTEST
Starts: 1200 UTC February 8
Ends: 1200 UTC February 9

Use all bands, 160 through 10 meters, CW and SSB. No crossmode operations are allowed and please use the band sections according to the IARU recommendations. Each station may be worked only once per band regardless of mode. Operating categories include single operator, multi-operator, and SWL.

EXCHANGE:

RS(T) plus sequential QSO serial number starting with 001. Dutch stations will send their two-letter province abbreviation instead of a QSO number: GR, FR, DR, OV, GD, UT, YP, NH, ZH, ZL, NB, and LB.

SCORING:

Each QSO with PA, PB, or PI counts one point. Multiply QSO points by the number of provinces worked on each band (6 × 12 = 72 maximum). SWLs count one point per Dutch station heard and multiply by provinces heard on each band (72 maximum).

ENTRIES:

As usual, a score calculation is required. Please use a multiplier column and insert multipliers only if they are new. A log must be signed for observation of the contest rules. SWL logs must contain code groups given by the Dutch station and the foreign station worked. Send logs not later than March 31, 1986, to: F. Th. Oosthoek PA0INA, PO Box 499, 4600 AL Bergen op Zoom, Netherlands.

A certificate will be awarded to each country winner in each category along with the second- and third-place stations, provided there is sufficient participation in that country. Certificates will also go to winners in each call district of JA, LU, PY, UA9/0, VE/VO, VK, W, ZL, and ZS.

ARRL INTERNATIONAL DX CONTEST
CW
Starts: 0000 UTC February 15
Ends: 2400 UTC February 16
Phone
Starts: 0000 UTC March 1
Ends: 2400 UTC March 2

The annual DX contest for all DX hunters is sponsored by the ARRL and open to all amateurs worldwide. W/VE amateurs are to work as many amateur stations in as many DXCC countries as possible on 1.8 to 30 MHz, excluding the 10-MHz band. Foreign amateurs are to work as many W/VE stations in as many states and provinces as possible. Check January, 1986, *QST* for any last-minute rule changes. Operating categories include:

(A) Single operator—one person performs all operating and logging functions. Spotter nets are not allowed and only one transmitted signal may be used at any given time. Within the single-operator category participants may compete within allband or single-band categories as well. Single-band entrants who make contacts on other bands should submit logs for checking purposes.

(B) Multi-operator—more than one person operates, checks for duplicates, logs, etc. Within this category entrants may compete within single-transmitter, two-transmitter, or unlimited-transmitter categories. Single transmitter implies only one transmitted signal at any given time and once station has begun operation on a given band, it must remain on that band for at least 10 minutes. Listening time counts as operating time. Multi-op single-transmitter stations must keep a single, chronological log for the entire contest period.

Two-transmitter multi-op entrants are limited to only two transmitted signals at any given time. Again, each station must stay on a given band for a minimum of 10 minutes. Both transmitters may work any and all stations; the second transmitter is not limited to only working new multipliers. Each of the transmitters must keep a separate log.

With an unlimited number of transmitters for multi-op entrants, only one transmitted signal per band is permitted at any given time. Separate, chronological logs must be kept for each band.

(C) QRP—10 Watts input or less (or 5 Watts output or less), single operator, allband only.

Each operator must observe the limitations of his license at all times. Your callsign must indicate your DXCC country station location. One operator may not use more than one callsign from any given location during the contest period. The same station may be worked only once per band, no crossmode, crossband, or repeater contacts. Aeronautical- and maritime-mobile stations outside the US and Canada may not be worked for QSO or multiplier credits by W/VE stations. All transmitters and receivers must be located within a 500-meter-diameter circle, excluding directly connected antennas. This prohibits the use of remote receiving installations. However, multi-operator stations may use spotting nets for multiplier hunting only.

EXCHANGE:

W/VE stations send RS(T) and state or province. DX stations send RS(T) and power as three-digit number approximating transmitted input power.

SCORING:

All stations count 3 points per valid QSO. W/VEs multiply QSO points by sum of DXCC countries (except US and Canada) worked per band. DX stations multiply QSO points by number of US states (except KH6/KL7) and District of Columbia (DC), VE1-7, VO, and VE8/VY1 worked per band (58 maximum per band).

AWARDS:

Plaques awarded to top W/VE scorer in each entry category, top scorer in the single-operator allband category worldwide and on each continent, worldwide leaders in the single-operator single-band, QRP, multi-op single-transmitter, multi-op two-transmitter, and multi-op unlimited categories, plus additional special plaques as sponsored.

Certificates will be awarded to top single-operator allband entries from each country and ARRL section; top single-band entries in each US call area and each country; top multi-op entries in each country, US call area, and in Canada. Additional single-band and multi-op certificates will be awarded if significant effort or competition is displayed. Also, DX entrants making more than 500 QSOs on either mode will receive certificates. ARRL-affiliated clubs also compete for gavels on three levels: unlimited, medium, and local clubs.



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

ENTRIES:

All entrants are encouraged to use official forms available from the ARRL to report contest results. Logs must indicate times in UTC, bands, calls, and complete exchanges. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 QSOs total must include cross-check sheets (dupe sheets). All operators of multi-op stations must be listed.

Entries must be postmarked within 30 days of the last contest weekend, otherwise they will be classified as check logs: no extensions, no exceptions. All stations are requested to send their entries in as early as possible. Each entrant agrees to be bound by the provisions of the ARRL rules, licensing authority, etc., and the decisions of the ARRL Awards Committee are final. Usual ARRL disqualification rules apply. Address entries and forms requests to ARRL Headquarters, 225 Main Street, Newington CT 06111.

RTTY WORLD CHAMPIONSHIP
0000-2400 UTC February 22

Sponsored by *The RTTY Journal* and *73* Magazine. The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 16 hours maximum, while multi-operator stations may operate the entire 24-hour period. Off times are no less than 30 minutes each and must be noted in your log(s).

Operator classes are (a) single operator, single transmitter, and (b) multi-operator, single transmitter. Entry categories are (a) single band, and (b) allband, 10-80 meters.

EXCHANGE:

Stations within the 48 continental US states and Canada must transmit RST, and state, province/territory. All others must transmit RST and consecutive contact number.

SCORING:

5 QSO points for contacts with W/VE stations located within the continental US and Canada. 10 QSO points for all other contacts. 1 multiplier point will be awarded for each of the 48 continental US states (a District of Columbia contact may be substituted for a state of Maryland multiplier), Canadian provinces/territories, and DX countries worked on each band (excluding US and Canada). Total QSO points times total multipliers equals claimed score.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts, Canadian provinces/territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 25 QSOs must be worked to be eligible for awards.

ENTRIES:

Entries must include a separate log for each band, a dupe sheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms. All entries must be postmarked no later than March 22, 1986, and sent to RTTY World Championship, c/o *The RTTY Journal* 1155 Arden Drive, Encinitas CA 92024.

Operating in excess of legal power, manipulating scores or times, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

ALABAMA QSO PARTY
Starts: 1600 UTC February 22
Ends: 2300 UTC February 23

Sponsored by the Birmingham Amateur Radio Club. Work stations once per band and mode. Work mobiles and portables again as they change counties.

EXCHANGE:

Signal report and QTH (county for Alabama stations; state, province, or country for others).

FREQUENCIES:

CW—1.810, 3.550, 7.050, 14.050, 21.050, 28.050. Phone—3.900, 7.260, 14.300, 21.360, 28.600, 50.110, 144.20, 146.52. Novice—10 kHz up from the low end.

SCORING:

Count 2 points per phone QSO, 3 points per CW QSO. Alabama stations multiply by total states, provinces, Alabama counties, and countries. All others multiply by total Alabama counties (67 maximum). Multiply scores by 1.5 for 200 Watts or less and multiply by 1.5 for noncommercial power (mobiles excluded from noncommercial multiplier). Mobiles add 500 bonus points for each county from which 10 or more QSOs are made.

AWARDS:

Trophies will be awarded to the top out-of-state station, top Alabama fixed/portable station, and the top Alabama mobile station. Certificates will be awarded to the top scorer from each state, province, country, and Alabama county. Certificates will also be issued for top Novice and Technician scores in and out of Alabama.

ENTRIES:

Mail entries by March 15, 1986, to Bill Levey WA4FAT, 3629 Dabney Drive, Birmingham AL 35243. Include an SASE for results.

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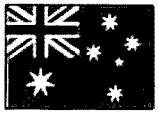
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73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, Pine Street, Peterborough NH 03458, USA, Attn: International Editor.



AUSTRALIA

J. E. Joyce VK3YJ
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Victoria
Australia

Following the short report in an earlier column about the 150-year celebrations in VK5, a letter sent to me by Mr. Graham Horlin-Smith VK5AQZ should be of interest, I feel, to any group planning a similar event. Graham is a controller of the South Australian 150-year celebrations, and the following is his report:

THE VK5 150-YEAR REPORT

Eighteen months of planning to link amateur radio with S.A.'s 150th birthday in 1986 reached fruition on Monday, May 27, 1985, when VK5JSA, the special-events callsign, was activated from the center of the city of Adelaide. The location was the Renaissance Center which overlooks the Rundle Mall.

Three operating points were established. At street level, a group of HF operators worked two rigs from an OB radio van, a Kenwood 930 and a Yaesu 757GX out of a 204 BA, 4-element monobander and a 40/80-meter trapped dipole, respectively, located on the roof of the seven-story building about 200' above ground level.

The second operation for CW and RTTY was located in Radio Rental's (Adelaide) ground-floor shop window (5-band trapped vertical also at 200'), and the third consisted of UHF/VHF, ATV, and a satellite display on the 6th floor (the restaurant), which had a commanding view of Adelaide and Repeaters 5 and 8 in the Adelaide Hills.

Computers by ICL demonstrating the link with amateur radio and substantial visual displays by the WIA S.A. Division, International Communications Services, Dick Smith's (Adelaide), the Department of Tourism, and the Jubilee-150 Committee complemented all operating points. Outside scenic lifts open into the restaurant, and an average of 2,000 visitors daily had direct eyeball contact with amateur radio during the week's operation.

The activity launched a program which will continue throughout 1986. As a result of this and other planned activities, VK5 amateurs expect to propagate 100,000 special Jubilee Souvenir QSL cards worldwide and 2,000 awards during 1986. The special issue welcomes amateur participation in S.A.'s 2,000 plus planned Jubilee programs and extends "Happy Birthday" greetings to S.A. in eight different languages. The first Grand Prix to be held in Australia will coincide with the commencement of a year of birthday parties. December 28th was S.A.'s Proclamation Day, and 1986 is its 150th birthday or sesquicentennial year. Come on over and enjoy S.A.!

S.A. has chosen to share and twin its 150th-year celebrations with Texas (Adelaide and Austin, Texas, being linked as twin cities). In excess of 170 towns and districts and 300 schools have been distinctively linked and exchanges have already commenced. S.A. amateurs see a role in providing the communications link to assist, where possible, with towns, schools, activity groups, and community and service organizations—a daunting task, but looked upon as a real challenge with a spirit of adventure which hopefully will be rewarding insofar as the hobby of amateur radio is concerned. Promotional-type activities and working with Jubilee activities, it is hoped, will provide a positive exposure of the hobby as well as an awareness and a better understanding of amateur activities in the long term.

"Amateur Radio Week, Promoting S.A." fired the first shot and launched the program. The official launch was by Dr. Ian McPhail, Chairman of the Bi-State Centenary Committee, in the VIP area of the Renaissance Center Restaurant on the 6th floor. Escorted tours, press releases, and media involvement in amplified amateur-radio links with Texas via San Francisco into the Mall focused the public's attention on amateur radio. Later, special appearances by Mr. Gavin Keneally, the Hon. Minister of Tourism and Local Government, and a special amateur link between Adelaide's Lord Mayor, Mr. Jim Jarvis, and Austin's Mayor Frank Cooksie were scheduled.

The WIA Committee of Jenny Warrington VK5ANW, Rowland Bruce VK5OU, and VK5AQZ acknowledged the financial sponsorship of the S.A. Department of Tourism, Estrow (Civil Engineers and Supervisory Consultants), Radio Rentals, International Communication Services, Dick Smith's, The Electric Bug, Captain Flash Advertising, Norman's Estates Winery, ICL, the South Coast ARC, the Renaissance Center Management (Emanual Group), Sound Out Services, the Renaissance Tower Restaurant Management, and the many amateurs themselves who contributed time and effort.

STICKY TAPE AND STRING

The problems of erecting temporary HF antennas on the roof of a city building were many. The most important consideration was to ensure safety for both the crew erecting the antennas and the general public below. Members of the antenna crew were no real worry, because one look over the side of an eight-story building is all it takes for self-preservation to take over; any thoughts of daring deeds vanish instantly.

The safety of the public is another matter. We had to erect an efficient antenna system that would stay put for the duration of the project, not fall off the building and cause injury below, not to mention rearranging the vswr and element spacing of the antenna.

The antennas we decided on were a 204 BA, 4-element, 20-meter monoband yagi, which was kindly made available to us by a gentleman from the near country, a half-wave dipole on 80 meters with traps for 40 meters, a couple of trapped verticals, and a VHF Slim Jim.

The installation of all these antennas took one and a half days working at a moderate pace, and although the roof now resembled an elaborate bird trap, antenna performance was interesting if not predictable.

The 204 BA exhibited a vswr of 1.1:1 right across the band. I suspect that the 300 meters of RG-8 might have been responsible for making it look slightly better than it was. The dipole, also fed with 300 meters of RG-8, underwent apparent vswr changes, as originally it was tuned using a short feeder. However, the result was still reasonable and well within the scope of the automatic AT units used. These antennas enabled the station to transmit strong signals, and generally we received very good reports.

Due to a high noise level, reception was not as good as we had hoped. The noise problem was the result of a trade-off between going for the efficiency of elevation and the local noise generated in the elevator control rooms. The trapped verticals, needless to say, were particularly susceptible to the noise, and as a result they weren't very successful.

Surprisingly, the Slim Jim performed well in spite of the tact that it also was fed with 300 meters of RG-8.

When the antenna crew assembled to disassemble the installation, one gentleman (as usual) was heard to suggest cutting the guy ropes and running. When handed a sharp knife and told that we would wait under several feet of concrete, he retracted his suggestion, we reverted to the original plan, and the antennas were lowered safely in about two hours.

NEW TOWER LEGISLATION IN VK3

New planning controls have been introduced in the Metropolitan area of Melbourne. After a long battle by the WIA, with many submissions to the planning authorities on behalf of all amateurs, it seems we have again gotten the short end of the stick. It also appears that no matter what we do in the way of community service, we amateurs are still a minority voice, as you will note by the regulations.

TV viewers can have antennas on thin towers as high as they like; CB operators can have their 4- or 5-element yagis up in the air with virtually no control, but we amateurs are governed down by the regulations if we want beam antennas on 15, 20, or 40 meters. Part of the new regulations follow:

A Radio Mast is a mast which, together with antenna:

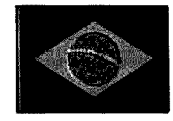
(1) exceeds a height of 14 meters above ground,

(2) when attached to a building exceeds a height of 5 meters above the roof line,

(3) has any horizontal distance in excess of 6 meters, or

(4) has a structure, not including the antenna, exceeding 50 centimeters in width at any point in excess of 3 meters above ground level.

With the attitude of some of our local councils, any new amateurs, without prior council approval, will have little hope of getting even a 15-meter dipole up into the air, let alone a TH6DXX at a reasonable height.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

PAULO SIMPLICIO PY7AQA

As I have written before, sometimes I have to travel due to my job. During these trips when I have free time, I like to visit friends, most of them known for more than twenty years through our contacts on radio.

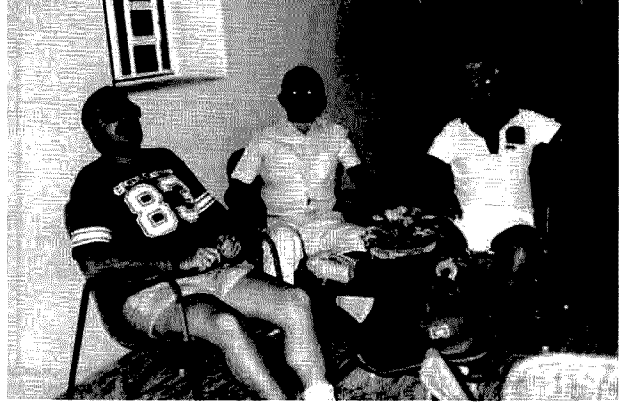
On my last trip to Recite (State of Pernambuco), I asked Bart PY7AKW (ex PY0CQ and PY0DX on St. Peter & Paul Rocks) to go with me to Timbauba, a very small city with many shoe factories. As you surely know, Brazil is the greatest exporter of shoes to the United States and you may be putting on a pair made in Timbauba.

In that city I was anxious to visit Paulo Simplicio PY7AQA, who is the first licensed amateur there. He is a very well known person by everybody. We didn't have his address, but it was not difficult to reach his house. We just asked people and they showed us the direction. The house was located on a very narrow street near the main square.

The last time I met Paulo personally was about eighteen years ago. On the bands he had an unmistakable voice—very grave and sounding like a thunderstorm.

Unfortunately, he lost that beautiful voice, so we will never hear it again. He got sick with cancer, and the doctors removed the upper part of the trachea containing the vocal cords.

He told us that after this serious sickness he thought that he would not have



L to R, PY1APS, Paulo PY7AQA, and Bart PY7AKW.

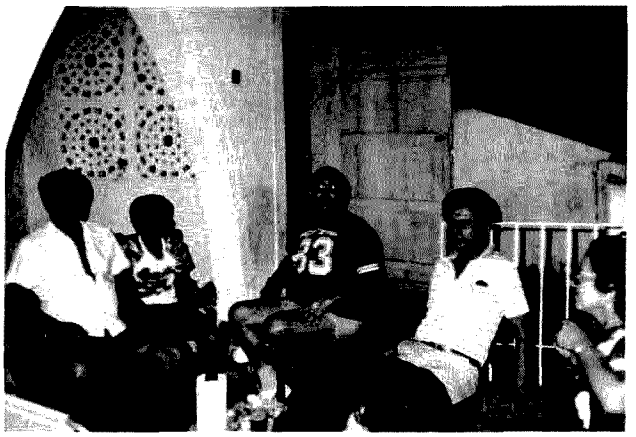
more than a few months of life, so he refused to learn how to speak again. After the first lesson, he gave up, disappointed.

In this way he lived for a few months. One early morning, he got up suddenly and told himself, "I am a man; I am not a cat!" At that moment he tried to work out how he could pronounce a syllable.

Day after day Paulo did the same. Nobody at home, even his wife, knew about his decision. A few months later he was able to speak again, and when his wife came to the breakfast table one day, he said, "Good morning—how are you?" Tears were a sign of their happiness.

Paulo himself wanted to tell the good news to his doctor, to surprise him also. . .and he did. In spite of many years in his profession, the doctor could not believe what he was hearing. Paulo PY7AQA was such a perfectionist that he had developed his own method, and he was talking almost as a normal person.

On our way home we stopped in Olinda and visited Firmino PY7SJ and Ivanildo PY7MM. We had oysters and beer and reflected upon the excellent day we'd had.



L to R, Firmino PY7SJ, PY1APS, and Ivanildo PY7MM.



INDIA

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Cochin 682 020
India

AMATEUR SERVICE RULES REVISED

The Wireless Planning and Coordination (WPC) Wing of the Ministry of Communications of the Government of India, by a notification dated October 4, 1985, has revised the Indian Wireless Telegraph (Amateur Service) Rules, 1978, to include more bands and operating privileges for different classes of radio amateurs in India.

A little while ago, when the Restricted Class License—the then no-code license—was introduced, the holders were authorized operation only on the 144-146-MHz band. With this revision, they are authorized both 144-146 MHz and 434-438 MHz on A3E, H3E, J3E, R3E, and F3E modes. Only terrestrial operation is permitted for which the maximum power usable is 10 Watts.

For holders of the Grade II license (the next higher class), the frequency and power authorized on V/UHF is the same. However, they are permitted to operate on A1A, A2A, F1B, and F2A modes also. The major changes for this category of license are in operational parameters—they are now allowed A1A, A3E, H3E, J3E, and R3E modes—on HF bands. However, authorization to work on voice modes is subject to the submission of proof of having made at least 100 contacts with other amateurs on CW. The new bands added on HF are 1820-1860 kHz and 3500-3700 kHz.

Grade I license holders, in addition to the modes permitted for the Grade II license holders, have A2A, F1B, F2B, F3E, F3C, A3C, and A3F modes on HF, VHF, and UHF. The maximum input power continues to be 150 Watts on HF and 25 Watts on V/UHF terrestrial. Additional bands given are 1260-1300 MHz, 3300-3400 MHz, and 5725-5840 MHz. Amateur satellite operation is also permitted in the appropriate subbands with a maximum output (eirp) of 30 dBW.

The holders of the Advanced Class license, the highest category possible for a radio amateur in India, are entitled to all the privileges of a Grade I license and are authorized to use up to 400 Watts dc input in the following subbands: 3520-3540 kHz, 3890-3900 kHz, 7050-7100 kHz, 14050-14150 kHz, 14220-14320 kHz, and 21100-21400 kHz. On VHF, the maximum dc input is 50 Watts for terrestrial operation.

In general, radio amateurs in India have almost all the frequency allocations possible in Region III, the best being the 1820-1860-kHz and 3500-3700-kHz allocations. This is especially true at this time, when the MUF goes down considerably as night sets in. And for the research-minded experimenters, the bands above UHF also are available. The allocation of 1820-1860 kHz is on the primary shared basis; 18068-18168 kHz on non-interference and the non-protection basis, and 1260-1270 MHz for Earth to space, Satellite Service only. We hope that these new authorizations of emissions and frequencies will boost up amateur activity in India considerably.

de VU2ARL

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Madras 600 006
India

INDIA CATCHES UP

One of the main demands of the Federation of Amateur Radio Societies of India, in their discussions with the Communications Ministry of the Government of India, was that all international allocations to the amateur service should be available to Indian amateurs.

After some foot-dragging and half-hearted releases of some band segments during the past two years, WPC (the Wireless Planning and Coordination Wing—India's FCC) has now gone the whole hog and announced a complete revision of the earlier allocations. The new announcement opens up all the HF, VHF, UHF, and microwave amateur bands to Indian amateurs, with the notable exception of the 6-meter band.

This relaxation is generally in line with the liberalization in all spheres—particularly radio communications (more on that in a later column). In a strange anomaly, 2-meter hand-helds still cannot be used in the mobile mode without a special 90-day authorization involving a US$0.80 fee and interminable waiting! In the generally liberal atmosphere, however, everbody ignores this requirement and nobody has ever been cited for breach of the law!

de R. Subha



ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

THE MEXICAN EARTHQUAKE

It would seem that with the huge distance separating Israel and Mexico, the earthquake disaster would have had very little repercussion here. However, as it turns out, with Israel's rich ethnic mosaic, there are many thousand Israelis with relatives in that stricken land. What ensued was one of the largest, if not the largest, public-service operation in the history of Israeli amateur radio.

When news of the disaster was given by the local media, it was stated that since all normal channels of communications out of Mexico had been disrupted, the only means of relaying messages was via radio amateurs. Almost immediately, hams all over Israel began to receive phone calls from people concerned about the fate of their dear ones in the disaster area.

One of the first contacts was made between David Ben Bassat 4X4WH (see photo) and Shimon Kushnir XE1GGU. The amateurs around the country organized themselves, with amateurs in each city receiving phone calls from those concerned, collating them, and having the messages handled by those in contact with Mexico. The radio and TV gave out the phone numbers of the key amateurs in each area, and for a week the phones were ringing almost nonstop at their homes.

With the ionosphere being quite fickle at this time of the sunspot cycle, especially over such a long haul as between Israel and Mexico, stations in between helped out with the relays—such as Mel G4WMP and two Washington area hams, David K3STM and Jim K3JW, who put in overtime. Later on, about a week after the first quake, the Ministry of Communications eased the strain on the ionosphere by putting in a free telex line to K3JW from Israel.

As well, early on in the operation, a list of the areas of Mexico City that were struck or were OK was circulated among the amateurs so that in many cases they could put callers immediately at ease. The "mailbox" in the Haifa RTTY repeater was pressed into service, carrying a lot of the message load, and proved to be quite instrumental in easing pressures.

When the operation wound down, about a week and a half after the earthquake, thousands of telephone calls had been processed. Quite a few amateurs had literally worked themselves to exhaustion, and a few score had been involved in this public service. Amateur radio had received, once again, so soon after 4Z4ZB's contact with the space shuttle, great publicity, with pictures of 4X4WH and his station and antennas having appeared on the national TV news.

I have really not even begun to name the amateurs here who worked hard in this endeavor, as they are many, and I would doubtlessly risk overlooking a few. Hats off to them all!



Inauguration ceremonies at the Silent Keys' Forest. (L to R) Shlomo Ariav and Mrs. Vicky Alkalai, Forestation Authority, Ozzie Osrin 4X4CW, and Aharon Kirschner 4X4AT. (Photo by 4X4GT)

THE SILENT KEYS' FOREST

One of the most popular ways that we in Israel remember those who have passed on is the planting of trees, a living memorial to them. With this custom in mind, Ozzie 4X4CW, the chairman of the Israel chapter of the Quarter Century Wireless Association and Israel's first licensed ham, conceived the idea of a grove to commemorate our Silent Keys.

After negotiations with the Keren Kayemet (JNF), the Israel Reforestation Authority, and a drive amongst hams and the families of the Silent Keys, enough money was raised for the planting of the grove, and daily contributions continue to come in for more trees.

On October 22nd, the Silent Keys' Forest was officially inaugurated with a ceremony at its site in the Ben Shemen forests in the hills overlooking the coastal plain near the Ben Gurion airport. The view there is quite spectacular, and it is indeed an ideal spot for Field Days that no doubt will be held there in the future.



Ozzie 4X4CW (left) watches General Mordechai Bar Dagan and Prof. Amnon Rubenstein shake hands at the Silent Keys' Forest ceremony. David Ben Bassat 4X4WH is behind, and Froike 4X4AF is on the right. (Photo by 4X4GT)

At the ceremony, many VIPs were present, including the Honorable Professor Amnon Rubenstein, Minister of Communications, Leland Smith W5KL, president of the QCWA who had come in from an archaeological trip in Egypt for the occasion, the chief officer of the Israel Defence Forces Signal Corps (General Mordechai Bar Dagan), the head of the Keren Kayemet Reforestation branch, and, of course, the Israel Amateur Radio Club officers and those responsible for seeing the project through. The event was attended by over two hundred amateurs, their families, and families of the Silent Keys.

Speaking at the podium, the Minister of Communications praised the hams for their strong record of voluntary public service and said that in the expected era of peace, radio amateurs will play a vital role, helping to build bridges between us and our neighbors, replacing hostility with friendship.

The ceremony closed with the planting of saplings by the families of the Silent Keys and the VIPs. Although the forest is really only in its infancy, with about 2000 trees donated, already picnic tables and benches are there, and it will be a place close to the hearts of all the radio amateurs in Israel.

THE TEL-AVIV-JAFFA AWARD

A new award has been made available to licensed amateurs and SWLs called the Tel-Aviv-Jaffa Award. Issued by the city of Tel-Aviv-Jaffa, it is in color, bears a picture of the city's boardwalk, and is signed personally by the mayor.

A minimum of ten points is required, Tel-Aviv stations counting for one point, Jaffa stations for five, and if you were fortunate enough to have worked 4X75TA when it was in operation last year during the 75th anniversary of the founding of Tel-Aviv, then you receive ten points for that contact. Only contacts made after January 1, 1984, count.

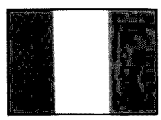
Do not send QSLs but rather a list containing the details of all the contacts; the list should be signed by two other licensed amateurs. The fee is either $3.00, 8 D.M., or 2 pounds sterling, and all the above should be sent to the award manager: Shlomo Mussali 4X6LM, PO Box 8225, Tel-Aviv 61081, Israel.

YAWN

In these days of rapid developments in technology, yesterday's achievements are taken for granted—commonplace. Such was the case on Saturday, November 2nd, when one excited ham phoned the hot line of a popular radio station to be the first to report on 4X4AS, 4X4GI, and 4Z4ZT making direct two-way contact on FM with DJ0SL on the orbiting Spacelab during orbit 41. (On all other orbits, DJ0SL only made recordings of calling stations.)

The voice at the other end of the telephone answered, "So what?"

After the huge publicity received by 4Z4ZB's contact with W0ORE on a previous flight of the shuttle, apparently this is no longer news. Incidentally, this was 4Z4ZT's first satellite QSO, using only a 5/8-wavelength whip, and, in his excitement, leaving his set in the 5-Watt position!



ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
21029 Milano
Italy

We had the opportunity some months ago to introduce you to I0FCG—Francesco Cossiga, the President of the Italian Senate. The most important information to report to you now is that he has been elected President of the Italian Republic.



The Knights of the Laid Table.



HV2VO and KD7RQ with I2SM.

He has received close to 90% of all the votes of the Parliament and the Senate and surely the support of 100% of the Italian hams.

The press has not reported correctly his ham activity, having some confusion with CB, but our hobby has received a lot of free "advertising" in all newspapers.

A few minutes on the first channel of the national television have been devoted also to Andrea I8WY—who at the end of July contacted the space shuttle on two meters. A simulated contact with the recording of the QSO has been shown during the main news broadcast.

The RadioRivista, the magazine of the Italian League, is devoting more space to microcomputers. From a survey it appears that locally the average amateur is 37 years old, is interested in computers, has tried at some time to build something himself (mainly antennas), and is interested in awards (37% have obtained the local awards while 31% are in some way interested in the DXCC).

Our average ham is reading 2.75 magazines devoted to radio or computers per month and spends $600 per year for rigs. He is mainly using SSB (92%), some CW (42%), and FM (66%). He likes to exchange QSL cards via bureau (62%) and direct (73%), even if this second method does not work too well.

This first survey will be followed shortly by a second one on a broader basis, and it will be very useful to give to the League some indications on the policies to follow in the near future.

A new contest group has started operating from the Milano area. It consists of three hams, Giorgio I2VXJ, the ARI Contest Manager, Paolo I2UIY, the Secretary of the ARI DX Club, and Mario I2MQP, the



Leland Smith W5KL, QCWA world president (right), Helen Smith WA5WAR, and Shimshon Lotan 4X4GF at the Silent Keys' Forest ceremony. (Photo by 4X4GT)



I2BVS operating from IB0.

HF and DX Manager. The group has been called "The Knights of the Laid Table" and intends to participate in all the main contests. One problem during the first operation was that no one agreed to operate while the others were eating—he was afraid to find nothing left for him.

If you look at the photo you will understand. I2UIY and I2VXJ are with guest operator Jimmy WA2JNN during the WPX CW. It was one of several pizza breaks, and from the pizza size you can understand it was not a short one. It can jeopardize results, but it does not matter. Food, wine, and *dames* are our main interest; radio is only second.

1K2DVG, I2CZQ, and I0GPY operated from HV2VO. Many contacts have been made on the low bands from the Vatican, thanks to a special antenna, a vertical wire 80 meters high, erected with a small aerostat. It has performed very well on 80 and 160 meters and will be used again in the future.

Another photo shows HV2VO with KD7RQ and I2SM.

Max I2DMK

Let's give a look to what has been done by I2DMK during his 26th and 27th expeditions. The first was from June 4 to 12 with Max I2DMK and Enzo I2BVS to IB0, Ventotene Island, IOTA EU 45. The island is in the Tyrrhenian Sea, 15 miles from the coast. It is 2 miles long and less than 1 mile wide. It was used for a prison during the Roman Empire and during the last war. A GP for 40 and 80 meters was installed together with a 2-element beam for 10, 15, and 20 meters. 4500 QSOs were made, 60% CW and 40% phone. On June 8, the island of Santo Stefano was activated on all bands with 400 contacts. The station was installed in a sentry post of the old penitentiary.

August was the month of the expedition of Max I2DMK to Stromboli, IOTA EU 17, with the usual callsign of I2DMK/ID9. Operations were on all HF and VHF bands, both CW and SSB.

Stromboli Island has a surface area of 5 square miles, and it has the only volcano in Europe where perennial eruptions come from its three mouths, shooting incandescent masses and burning lapilli towards the sky.

For both operations, QSL via I2MQP



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

IARU CONFERENCE, 1985

1985 was the Diamond Jubilee of IARU, and New Zealand was honored to be the host country for the Region III Conference—the 60th anniversary of the founding of the International Amateur Radio Union. It was held in Auckland.

The IARU is the link between over 2 million radio amateurs in 122 countries and the International Telecommunications Union, of which the Amateur Service and the Amateur Satellite Service are part. Formed in 1925, the IARU has observer status at all ITU conferences. It is controlled by an administrative council drawn from its three regions and an International Secretariat provided by the American Radio Relay League. The Regions of IARU are Region I, Europe, Africa, and the USSR; Region II, the Americas, and Region III, the rest of the world.

NZART is a founding member of the Region III association and plays a leading role in its activities. Each IARU Region holds a triennial conference so that there is a regional conference each year.

As NZART was the host society, I will report on the event in my next column.

RAOUL ISLAND

Chris Hannagan ZL8OY/ZM8OY will be operating from Raoul Island (Kermadecs) through September, 1986, while on a tour of duty at the weather station on the island. Chris will be operating mostly in the evenings (about 0600Z onwards) on the usual DX slots of the various frequencies, both phone and CW. He does NOT operate nets or lists. He will be using an ICOM 701 and a home-brew linear on the HF bands and an ICOM 560 for six meters.

Antennas will be delta loops for 80 and 40 meters, a three-element TET yagi for 20/15/10 meters (if the parts arrive in time), a vertical for 160 meters, and a five-element yagi on 6 meters.

Chris looks forward to many QSOs while on Raoul—many DX operators will have worked him when he was on Chatham Islands recently, and may also have worked him from the Auckland Islands—all QTHs Chris has been to on tours of duty with the weather service. QSLs to ZL4OY (Chris Hannagan, The Terrace, Warrington, Dunedin, New Zealand) or the QSL Bureau will be handled during his absence by his XYL.

WARNING

Recently an amateur received a warning letter because his station was not being operated in a manner in keeping with the spirit of amateur radio and the regulations. He had been monitored by the official monitoring station, which observed the following: The station tried to break into a conversation between two other overseas stations by repeating just the first two phonetics of his station callsign over and over. He repeated this continuously for 20 minutes before he was finally acknowledged. Only then did he give his FULL callsign.

How often do we hear this on the DX bands? Harmless enough, some might say, but it is in conflict with regulations because it creates "harmful interference." Infringes on the proper use of the callsign, and is way out of line with the Amateurs Code. Think how other amateurs hearing outbursts of this type would judge fellow amateurs in the offender's country. Consideration for others is a virtue not practiced as well today as it used to be in my early days of ham radio.



POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

The IX National Congress of PRAA, which took place in Warsaw, adopted a program of activity including work on crucial problems of development of the Association. The Congress recommended that PRAA reconsider the organizational structure of the Association and even to liquidate non-active, small District Boards. The Congress also recommended restricting the number of domestic competitions and certificates.

The PRAA planned to obtain permission to work with portable and mobile devices, with a second QTH, and on new bands for its members. The Association would work for cancellation of the order of the Ministry of Communication allowing possible refusals to issue or the cancellation of a ham license without giving the reasons. The Headquarters of PRAA hoped to publish a register of Polish amateur-radio stations and bring it up to date.

The PRAA will collaborate with other institutions to work out national standards for technical parameters of electronic devices relative to their electromagnetic compatibility.

The following were selected to PRAA: Jerzy Rutkowski SP5JR, President; Wiktor Chojnacki SP5QU, Stanislaw Maciejkiewicz SP2JS, and Pawel Kaniut SP9RG, Vice Presidents; Secretary General—Jerzy Miskiewicz SP8TK; Treasurer—Zbigniew Klossowski SP4BQW; SW Manager—Jacek Rutyna SP9AKD; UHF Manager—Zbigniew Malik SP6AZT; ARS Manager—Jerzy Klabon SP3FFN, and Member in charge of propaganda and youth—Jan Ladno SP5XM.

I will write later on what the PRAA work accomplishes.

In April, 1985, a respected member of PRAA, Wiktor Chojnacki SP5QU, died. His writings informed readers of *Polish Ham* magazine about current events in the radio-amateur movement. Editor-in-chief of the *Bulletin* of PRAA, he prepared his twenty-fifth jubilee issue. SP5QU won the second prize of "Master of Technology" for collaboration on the production of a radiotelephone, "Klimek," for needs of the mountain rescues. The Polish radio-amateur movement has lost a strong friend.

The first Conference of the Polish Radio-Videography Club took place in Torun in May. Present were 104 delegates from Poland and the foreign visitor, Y23NE. A sports commission verified QSLs and granted the first licenses for the full members, SP2JPG, SP3CMX, and SP3LRS. Lectures were delivered on club activities by SP2JPG, SP2DDV, SP3CAI, SP3CMX, SP3LRS, SP3GAX, SP6GTN, SP6NVA, SP7CHY, SP8JMW, SP9BWJ, and Tomasz Ilkow.

Many participants demonstrated their home-brew items and others brought factory-made devices. The resolution committee prepared a comprehensive report for PRAA authorities.

Polish hams took part in international contests in the last three months of 1985 involving Oceania, Spain, Portugal, America, Australia, and Canada.



PORTUGAL

Luis Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril 2765
Portugal

SATELLITE TV IS HERE

According to the Mayor of Lagos, a parabolic dish will be installed in Valverde for the reception of satellite TV signals from several TV networks. Talks with the Secretary of State for Communications have started to find out the best place for construction of the receiving station.

The project is part of an official program which will include installation of several other dishes, one in Santarem and two in Lisbon. The priority project will be the one located in Valverde due to the big concentration of visitors in that particular area to the several well-known holiday resorts.

But this isn't all. Similar equipment, on a reduced scale, was built and installed by a small group of CT operators where French and German hams also were involved. With this simple but effective homemade TVRO, they've had good results. Signals from several European TV networks were seen without too much trouble (HI).

WORLD TELECOMMUNICATIONS DAY

This year, the events for this celebration took place in Oporto. The Associacao Portuguesa Para O Desenvolvimento das Telecomunicacoes (Portuguese Association for the Development of Communications) put together an interesting schedule with other state departments in this field. They were to let people know a little more about the wireless world; they were appreciated by students, technicians, engineers, etc.

FIRST CONGRESS OF TELECOMMUNICATIONS

If everything goes on schedule, this important meeting will be held this month (February, 1986). It will be devoted to developments and changes. Foreign representatives are expected. Forum Picoas in Lisbon (opened recently) has all the facilities needed for such meetings, so the Congress will be there.

VISITORS IN LISBON

Once again, we've had a visitor here in the shack, Tom Phipps KA4CSG, from Texas (I'm sorry, Tom! We don't have any rodeos in this country) was here and we had a nice chat. Many thanks, and keep crossing the Atlantic. You are always welcome.



Tom Phipps KA4CSG, Ft. Hood, Texas, left, with CT4UE.

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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	[illegible]					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15[1]	20[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*						15	15	20	20	
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 = May be open only once or twice during month.
*** = Try next higher band.**

G = Good, F = Fair, P = Poor.

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F
2 G	3 F	4 G	5 F-P	6 P-F	7 F	8 F-P
9 P	10 P	11 P-F	12 F-G	13 G	14 G	15 G
16 G	17 G	18 F-P	19 P	20 P-F	21 F	22 F-P
23 P	24 F	25 G	26 G	27 G	28 G	

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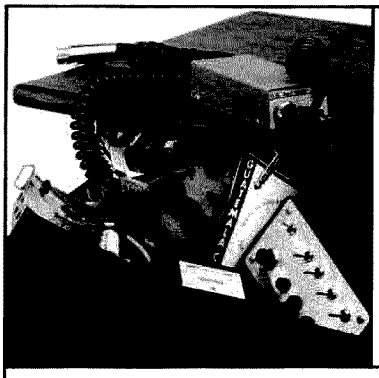
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73 for Radio Amateurs®

ISSUE #306 MARCH 1986

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Gadgets, gadgets and more for the tinkerer! And yes, Wayne's back. Photography by Frank Cordelle, Bennington, NH.

9 Japan's Hush-Hush Rushbox
These units were ordered destroyed after WWII, but a few fell into the hands of collectors. Now, after 40 years, PA0SE analyzes the Imperial Army's secret radio. PA0SE

17 Halt That Hum!
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Discover hidden savings in the last place you'd ever look—the instruction manual. N6HYK

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4 QSL of the Month
7 QRX
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NEVER SAY DIE



WELL, I'M BACK

I'm deeply concerned about a type of mental illness, spread by hams, which is going around. It's not a new one—actually, it's shown signs of dying out in recent years. It's a virus-like illness which can hit people at any age, but which tends particularly to hit boys around puberty. For the lack of a better name, I call it the Ham Infection—HI.

I remember the first time I was exposed to it. I was about ten and my grandfather introduced me to Fred Stevenson W1CUN. Fred was slouched in a little building out in back of the Valley View Hotel in Bethlehem, New Hampshire, his legs intertwined in a chair, with his obviously home-made ham rig, built on a board, blazing away as he talked. I can still see it. And how incredible that 15 years later I'd be operating my own ham station from this very same shack.

You can bet I began tuning any radio with a shortwave band on it up above the broadcast band—past the police calls at 1600 kHz—to hear the hams talking on the 160-meter band. Wow! I'd been infected.

Oh, I suppose I was predisposed. My mother's father was an inventor—made over a million at it back in the 20s when that was a lot of money. He was into the high tech of his day—invented the first thermostat for gas stoves, for instance. My father was into flying, the high tech of his day. So I was a sitting duck when Fred happened to me.

Now, every one of you reading this is a carrier of this mental illness. Yes, you have the power to infect dozens—even hundreds—of susceptible youngsters. I've known some hams, like Bill Welsh W6DDB, to infect thousands. He even infected his wife, Marie W6JEP! Women, for some reason, are usually resistant to HI.

Speaking of wives, I realize that many of them think of HI as a dread illness, one which siphons money from the family income for expensive ham rigs and ugly towers with sprouting antennas to make their homes eyesores in the neighborhood. The accompanying TVI alienates many of the neighbors. Heck, she can't even get the OM to go to work if a rare country he hasn't contacted is scheduled to be on the air. And then there are all those weirdos who track dirt through her living room, going into the hamshack to talk gibberish!

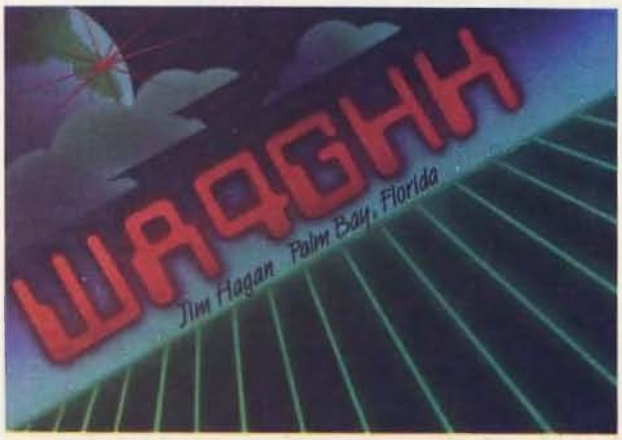
The Ham Infection is different from most mental aberrations, such as religion and politics, both of which require extensive exposure to become established. The Ham Infection can happen in minutes—and last a lifetime. It's in some ways like narcotics or alcohol in that those of us who have it enjoy it—it's our families and friends who suffer.

The answer to that problem is simple—infect as many of your family and friends as you can. Then you'll all enjoy the madness together. Let's get together on this and pool our resources. I know some ways to spread HI, but I'll bet you know many ways I haven't thought of yet. So drop me a note with your suggestions on what you've found successful.

Remember, our mental problem is only an aberration because there are so few of us—less than 0.2% of the US population. In Japan, where about 1.6% have HI, it's almost respectable. It looks as if we might begin to see daylight at around 1%—about 2.2 million licensed hams. That's a good goal, right?

Not to throw cold water on you CW fanatics, but if Fred had been batting a key around instead of talking over his ham rig back in 1931, I'd probably be a lawyer today. And heaven knows we sure don't need another lawyer. Some of my best friends are lawyers, but I sure wouldn't want my daughter to marry one.

Continued on page 67



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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QRX. . . .

EDITED BY PERRY DONHAM KW1O

RM-5241

DON STONER W6TNS has filed a Petition for Rulemaking with the Federal Communications Commission which would establish a **Public Digital Radio Service** in the amateur six-meter band. In his (very convincing!) petition, Stoner outlines the need for the new allocation by describing the explosive growth in the use of modems, the plummeting price of personal computers, and the sharp increase in the cost of accessing the telephone network. Don believes that these three factors make the time ripe for a low-power digital service. Why six meters? According to Stoner, "Out of 400,000 radio amateurs in the United States, less than 1,000 are active in the six-meter band." He goes on to state that, due to the potential for interference to TV Channel 2, nearly all amateur operation is in the lower 2 MHz of the amateur band (50–52 MHz). It is the band from 52 to 54 MHz that Don wants to use for the new service. The technical specifications for the PDRS are very stringent and specific: 1 Watt maximum transmitter output, use of only vertical antennas, and prohibition of remuneration are a few of the details that are laid out in the document. The channel usage would be very similar to our own packet-radio system, with only one channel being occupied by multiple stations using collision-avoidance schemes. Is it really time for a digital Citizens Band? I say it is. The ARRL's "Super Novice" ticket will fill a void in the amateur structure, but a new license-free computer-to-computer allocation is something that millions of telecommunicating Americans are hungry for. The FCC has assigned Stoner's petition RM-5241.

FEMA Fans

A PAIR OF HAMS from the Westchester (NY) Emergency Communications Association recently let their government know just how important amateur radio can be in a disaster. **Rich Moseson N2BFG and Don Storm K2MQR** spoke before a disaster-preparedness seminar sponsored by the Federal Emergency Management Agency. The talk included a video tape of hams performing emergency communications during disasters in California, and a handout containing names and telephone numbers of local amateur emergency personnel. Several seminar participants claimed that the duo's presentation was "the most interesting and educational of the day."

Looking

IF YOU WERE STATIONED with the **14th AACS Squadron** headquartered in Cairo during World War II, it's reunion time! Get in touch with one of these fellows for details: Bob Irons W9CSJ, Bill Eiler K9OIW, Ted Werling WA9OPJ, Paul Baumgarte WD8RJR, Chuck Cohen W2FQ, Art Masters N4LZX, Bill Ulbright W9LLQ, or John Fisher W1CLF.

CQ Ma Bell

WE MISSED THE BOAT on the no-code license, but New England Telephone was not so myopic! If you live in the Worcester, Massachusetts, calling area, you can dial **Phone-A-Friend**. This is an experimental service in this exchange which lets you dial a number and be connected with up to five other callers. At random. Sound familiar? There are separate numbers for "juvenile" and "adult" conversations. Sort of like the difference between 2m and 160m. And who knows? If this experiment is successful, AT&T may expand it to cover the entire country—and we'll finally get our no-code ticket.

Another Celeb

JOINING THE GROWING LIST of ham celebrities is Italian President **Franscesco Giuseppi Cossigna I0FGC**. Other dignitaries include Barry Goldwater K7UGA, Indian Prime Minister Rajiv Ghandi VU2RG, and Jordan's King Hussein JY1. Wouldn't it be great to get all of these folks together in one place? I would *love* to see the Prime Minister with an HT on his belt and a Dayton Hat-tenna on his head.

My callsign, eh?

MANY CANADIAN AMATEURS have been asked by the Department of Communications to give up their Q-signal suffixes. While the letters received by stations such as VE7QST are requests, not orders, the DOC has stated that they will no longer issue calls with Q-signal suffixes.

Tick Tock

THE CANADIAN DOC is also moving right along with their plan to restructure the Canadian Amateur Service. According to a report in the *CRRL News*, the majority of VE hams think that the proposal is a good one and do not see the no-code license as a detriment to the hobby. Briefly, the proposed structure is this: Three amateur certificates (licenses) will be available. Certificate A will have no Morse proficiency test. Holders will be given all modes on frequencies above 30 MHz, with a power output no greater than 250 Watts. Also, Certificate A licensees must use only commercially-built transmitters. Passing a 12-wpm Morse test will upgrade Certificate A to Certificate B, which adds all modes on frequencies below 30 MHz. A written examination on advanced electronic theory is required for Certificate C, which allows the holder to use homebrew equipment, transmit with up to 1,000 Watts output, and become a license holder for repeater and remote stations.

Where Am I?

THE TOP SECTION of our Top Band is no longer exclusively an amateur allocation. In order to provide additional spectrum for radiolocation systems that may be displaced by an expanded AM broadcast band, the FCC has given those systems primary status on the band from 1900 to 2000 kHz. Amateur stations may use this segment on a non-interference, shared basis and cannot expect protection from radiolocation signals. It's not as bad as it sounds, though, since the locators will be using spread-spectrum techniques: We may not even know they are there. Also, the FCC is not accepting applications for the new allocation until July of 1987.

Form Format

DON'T USE any FCC Form 610s issued prior to June, 1984, to apply for an amateur-radio license. If you do, the Commission will simply return your applications with a request to use the proper form. You can get copies of the new paperwork from your regional VEC, your nearest FCC Field Office, or the FCC Consumer Assistance Branch, Private Radio Bureau, Gettysburg PA 17325.

Bugged Beads

THE LAST THING a guy wants to worry about is his beads, right? Well, start worrying! **CCS Communication Control, Inc.**, recently discovered worry beads which contain an ultra-miniature radio transmitter. In the Middle East, worry beads are ubiquitous—they are carried to business meetings, while traveling or dining, and so on. CCS was called into action by a gentleman whose business dealings were somehow being leaked to his competitors. What the company found was two sets of beads with a tiny transmitter and a battery built into the largest bead; the transmitter had a range of about one kilometer.

QRV

DON'T FORGET to send in your news items and photographs! Mail them to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: QRX.

Dick W. Rollema PA0SE
v.d. Marckstraat 5
2352 RA Leiderdorp
Netherlands

Japan's Hush-Hush Rushbox

These units were ordered destroyed after WWII, but a few fell into the hands of collectors. Now, after 40 years, PA0SE analyzes the Imperial Army's secret radio.

Communication equipment used by the Allied forces during WWII has become well-known among amateurs, no doubt because enormous amounts have been sold by war-surplus shops for decades after the war ended. Quite different is the situation for German war-surplus material, even here in Europe near to the source of it. The explanation is that the Allied commanders were ordered to destroy all German war equipment that was found after the surrender in May, 1945. Some communication equipment escaped demolition, however, and now rests in museums and with collectors all over the world.

Whether a similar order was issued for Japanese wartime equipment is unknown to me, but the fact is that very few of those items found their way to collectors. This is true in Europe, at least, but I think the situation is not much different in the States. So it was with considerable joy that I accepted a very special birthday present from an old radio friend, Ber van Dongeren PA0DON: the Japanese portable transmitter-receiver pictured in Photo A.

The radio carries a wiring diagram on the inside of the lid (Photo B), but how it was used remained obscure until additional information was provided by Akira Kobayashi JA1JIX. The type number of the radio is 94-6. It was meant for use by the infantry, but found a variety of applications due to its simple operation. Communication distance is given as 2 kilometers.

Frequency is continuously variable in three subbands between 25 and 45.5 MHz. Power during transmission came from a hand-cranked generator, providing 3 volts at 0.35 Amps and 135 volts at 30 milliamps. On receive, power came from batteries for 3 and 135 volts. The antenna was an L-type: 1.4m horizontal and 0.65m vertical.

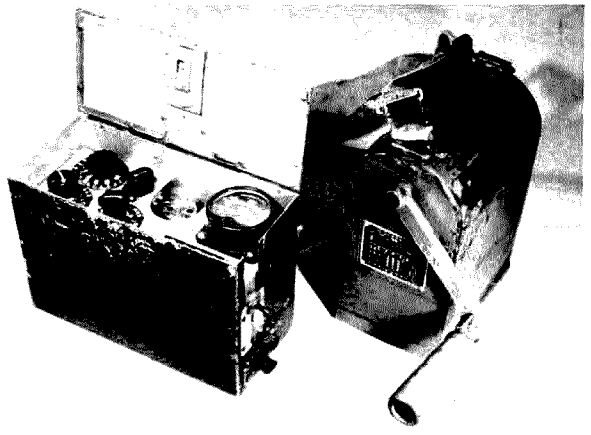


Photo A. Japanese WWII transceiver with hand-cranked generator used when transmitting.

Someone who can read Japanese characters told me that the engraving on the lid says the radio was manufactured by Takanashi in June, 1940. In red characters it says "Secret."

As compared to the sophistication of the modern Japanese sets that dominate the market, the model 94 radio is simplicity itself. There is only one tube, a double triode. The circuit is one that was very popular with amateurs for 56-MHz work in the early thirties. Indeed, the circuit could have been taken straight from *QST* or an *ARRL Handbook* of that period. As a receiver, one triode is a superregenerative detector and the other an audio amplifier. On transmission the first triode becomes a self-excited one-stage transmitter, anode-

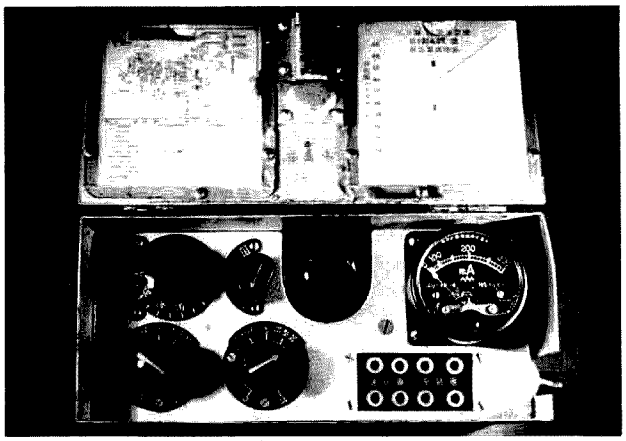


Photo B. Top view of the radio. Inside the lid are the circuit diagram and frequency calibration curves for the three ranges. On the radio, top row left to right: tuning capacitor C5 (see Fig. 4), frequency range switch S1, top of the tube, and antenna-current meter. Bottom: filament-current control R2, variable grid leak R1, and jacks for two handsets.

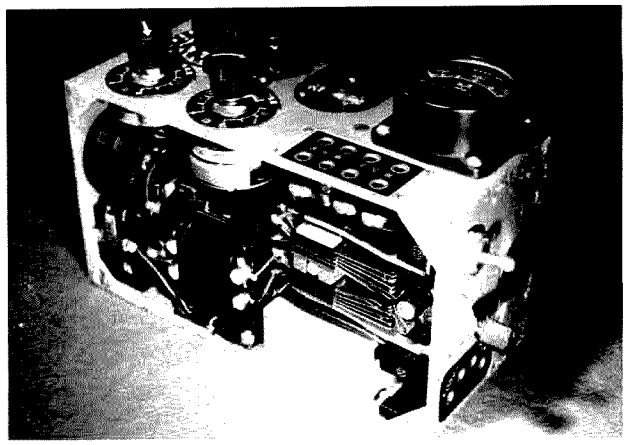


Photo C. At the right center, transmit/receive switch S2; above it, switch S3 to interrupt the microphone circuit when using telegraphy. Behind S2, the Morse "key" can be seen. At the bottom, the cable to the generator is plugged in. Inside the radio, transformer T1 is fastened to the bottom. Microphone transformer T2 is in a screened box below S2. The two round coils below filament-control R3 are L4 and L5, the tuning coils for the quenching oscillation.

modulated by the second triode.

Older readers no doubt will remember the superregenerative receiver or "rushbox." But to the younger generation this electronic marvel may be new. So we start with an explanation of this remarkable type of receiver, invented by that American genius Major E. H. Armstrong, who presented the system in 1922. (Armstrong also gave the world the superheterodyne receiver and the system of frequency modulation for VHF broadcasting!)

The Rushbox Explained

As mentioned, the superregenerative receiver was very popular for reception on VHF and UHF in the early thirties. To explain the principle, I therefore quote the *ARRL Radio Amateur's Handbook* of 1936. Fig. 1 was taken from that source.

First, a "normal" triode with a grid detection and regeneration (positive rf feedback) is explained. The *Handbook* then carries on as follows:

"The limit to which regenerative amplification can be carried is the point at which the tube starts to oscillate, because when oscillations commence, further regenerative amplification ceases. To overcome this limitation and give still greater amplification, the superregenerative *circuit has been devised. Essentially, the superregenerative detector is similar to the ordinary regenerative type but with a low, but super-audible (above audibility) signal introduced in such a way as to vary the detector's operating point at a uniform rate. As a consequence of the introduction of this* quench *or* interruption frequency *the detector can oscillate at the signal frequency only when the operating point is in a region suitable for the production of oscillations. Because the oscillations are constantly being interrupted, the signal can build up to relative tremendous proportions, and the superregenerative detector therefore is extremely sensitive. An elementary form of a superregenerative circuit is shown in [the illustration]. Superregeneration is relatively difficult to attain at ordinary frequencies, and does not possess the property of discriminating between signals of different frequencies characteristic of other types of detectors — in other words, the selectivity is poor. For this reason the superregenerative circuit finds its chief field in the reception of ultra-high-frequency signals, for which purpose it has proved to be eminently successful."*

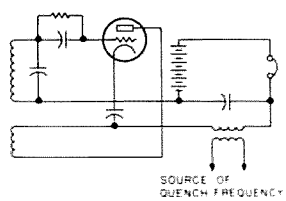


Fig. 1. An elementary superregenerative circuit as shown in the ARRL Radio Amateur's Handbook *of 1936.*

We can go a bit further into the theory by looking at Fig. 2. Here is shown how the signal in the tuned circuit grows exponentially from a starting voltage (V_{in}) to a maximum voltage (V_{max}). V_{max} depends on the anode voltage and maximum anode current the circuit allows to flow. When the voltage in the tuned circuit is higher at the moment the quenching signal makes the detector oscillate, the V_{max} level is reached sooner, as shown in Fig. 2 for a starting

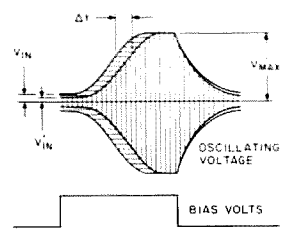


Fig. 2. Oscillating voltages in the superregenerative receiver ensuing from two starting levels, V_{in} and V'_{in} respectively, and finally building up to the same voltage, V_{max}. Lower section: Bias voltage as dependent on time, caused by the quenching oscillator. In reality the voltage is not rectangular but sinusoidal.

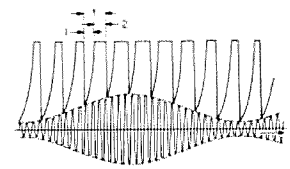


Fig. 3. Received signal, an amplitude-modulated carrier, and the variation of the rectified current through the tube. Starting from the amplitude of the recieved signal, the signal builds up during interval 1 and stays at the maximum level during interval 2. The sum of intervals 1 and 2 is t, the period of the quenching signal.

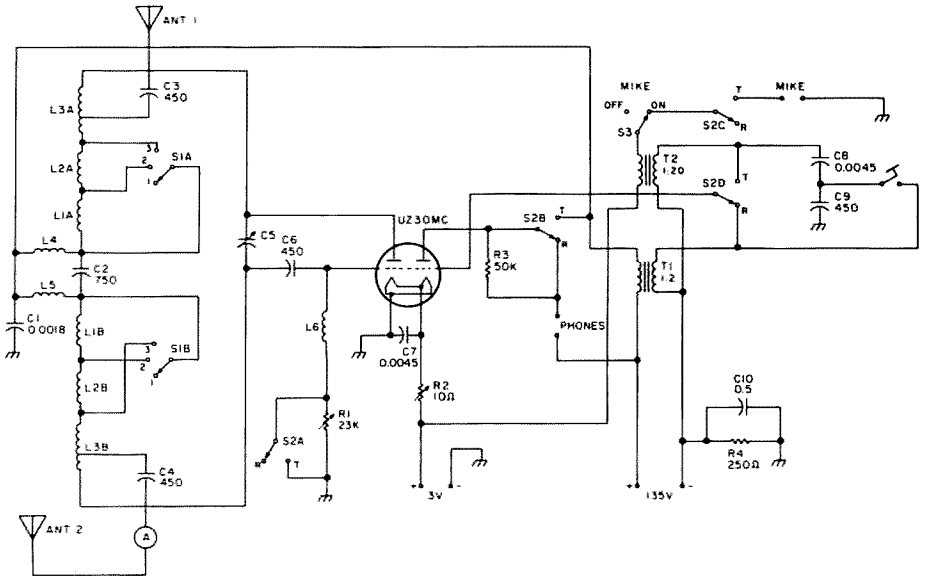


Fig. 4. Circuit diagram of radio type 94-6. The transmit/receive switching is somewhat simplified.

voltage of V'_{in}. The moment the signal decays is also governed by the quenching signal, but independent of the starting signal. So the total surface that is hatched in the illustration varies with the magnitude of the voltage on the tuned circuit at the beginning of each quenching cycle.

As the rf signal is rectified in the detector valve, the hatched area is also a measure for the anode current. This principle is further worked out in Fig. 3, which depicts an amplitude-modulated grid of the detector. The part of the quenching cycle during which oscillations build up has the duration t. So with intervals of t seconds, the anode current builds up as shown in the upper part of Fig. 3.

The buildup follows an exponential law. (For simplicity, the decay is shown as instantaneous at the end of each interval.) So t is divided into a period "1" during which the signal increases and an interval "2" in which it stays constant. It is shown clearly that the area which is a measure for the anode current follows the modulation envelope of the received signal. So in the anode currrent of the superregenerative detector we find the audio that was transmitted. When there is no signal voltage in the tuned circuit there still is thermal noise, which is amplified in the same way as a signal voltage.

This explains the hissing noise that is so characteristic of the superregenerative receiver—lovingly called a rushbox by amateurs of the thirties. As soon as a received signal overrides the noise sufficiently, the hissing sound disappears. In that respect, tuning a rushbox is very similar to tuning a modern FM receiver with the squelch turned off. The fact that circuit noise, perhaps a microvolt or so, is amplified to the full output level of a volt or more in the anode circuit indicates the enormous gain, which can be of the order of a million times. And that in a single stage!

In this respect, the superregenerative receiver is a real marvel, but there is more. The receiver features very good automatic gain control (agc) so that all stations are reproduced at almost the same level. Suppression of impulse noise is excellent, too. This is a very desirable feature on VHF, where automobile ignition noise can be very troublesome. Nowadays every car has good suppression, but before WWII this was more the exception than the rule.

So it seems that the rushbox has only desirable features. Are there no disadvantages then? Sure—selectivity is very poor, as already indicated by the *Handbook*. But even this might be called an advantage: The superregenerative receiver often was used in conjunction with very simple, self-excited, single-stage transmitters. These have very poor frequency stability. So poor that the signals from these transmitters on VHF are mostly unreadable on a superheterodyne receiver. No problem for the rushbox! Its passband is so wide that these signals, which swing all over the place, are coped with easily.

Now that we have refreshed our knowledge on this remarkable invention by Major Armstrong, it is time to return to our Japanese transceiver.

Circuit Analysis

The circuit diagram on the inside of the lid faded so much over the years that I was unsuccessful in making a satisfactory photographic reproduction, so the circuit was redrawn for Fig. 4. (For the sake of clarity, the transmit/receive switching is somewhat simplified.) This switch is visible in Photos A and C.

It is a classic telephone keyswitch with three positions. In the middle position, the set is turned off. The lower position activates the receiver and the upper position activates the transmitter. If both the hand generator and batteries are connected, the transmit/receive switch automatically selects the batteries for reception and the generator for transmission. (These features are deleted in Fig. 4.) S2 is the T/R switch with only two positions shown, T for transmit and R for receive.

The radio is tuned by coils L1, L2, L3, and variable capacitor C5. The frequency range is 25–45.5 MHz, and this is divided into three subbands selected by S1. On the lowest range, all three coils are used; on the middle band, L1 is short-circuited, and on the highest band, both L1 and L2 are short-circuited so that only L3 remains. The coils are three separate ones on formers that can be seen in Photo D. Each coil is divided into equal halves, A and B. Two antennas can be used, indicated as ANT.1 and ANT.2. Perhaps one was meant as an antenna and the other as a counterpoise? A thermocouple ammeter indicates current in ANT.2.

Let us now look at the circuit when the radio is used as a superregenerative receiver. S2 is in position R. The left triode is the detector. C6 is the grid capacitor and R1 is the variable grid leak. But where is the quenching signal coming from? From the same triode, playing a double role. It oscillates at the receive frequency and the quenching frequency at the same time!

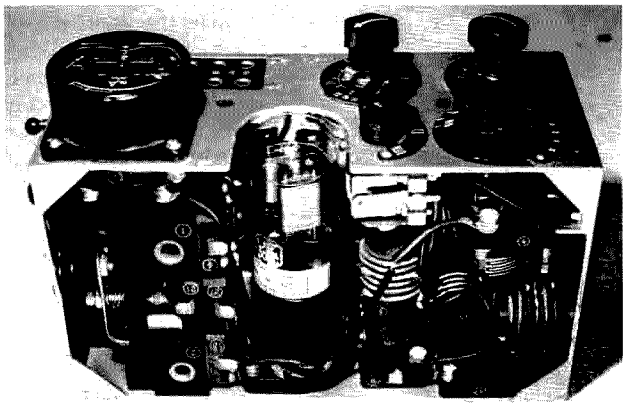


Photo D. At the right, tuning capacitor C5, and around it coils L1, L2, and L3. Left of the tube, the connectors for two antennas (or antenna and counterpoise), and at the extreme left, the Morse key.

The Japanese designers surely used a clever trick here.

I did not explain why coils L1, L2, and L3 were split into halves. The reason will become clear now. The A and B parts of the coils are connected via C2, which has a very low reactance at rf, so that for the receive frequency the coils can be considered as directly connected. L4 and L5 are closely coupled, as can be seen in Photo C, top left. They act as one coil with a center tap.

C2, L4, and L5 form a tuned circuit. As the center tap is grounded via C1, and grid and anode of the triode are connected to both ends of the circuit, the whole thing forms a Hartley oscillator that happily swings at around 29 kHz (according to my measurement). So that is the quenching signal.

The adjustment for optimum results as a superregenerative detector is always a bit critical, and this one is no exception. Both R1 and filament-current control R2 have to be readjusted when the frequency has been changed more than a little, to obtain the familiar rushing noise. The audio signal in the anode current is taken to the grid of the second triode via T1. The amplified signal goes to the phones. Two of these can be connected to the radio, and they are in the form of handsets that also carry the microphone.

Now we switch to transmit by moving S2 to position T. The left triode becomes a self-excited transmitter, anode-modulated by the triode at the right. S2A short-circuits grid leak R1. So the transmitter tube operates without bias. This is rather unusual, but some reflection brought me the probable explanation. The quench signal has to be stopped on transmission without interrupting the rf oscillation. This is surely effected by short-circuiting R1. Choke L6 has a very low reactance, almost zero Ohms, for the relatively low quench frequency of 29 kHz—so oscillation is impossible. For the transmit frequency, L6 has a high reactance and does not prevent rf oscillation.

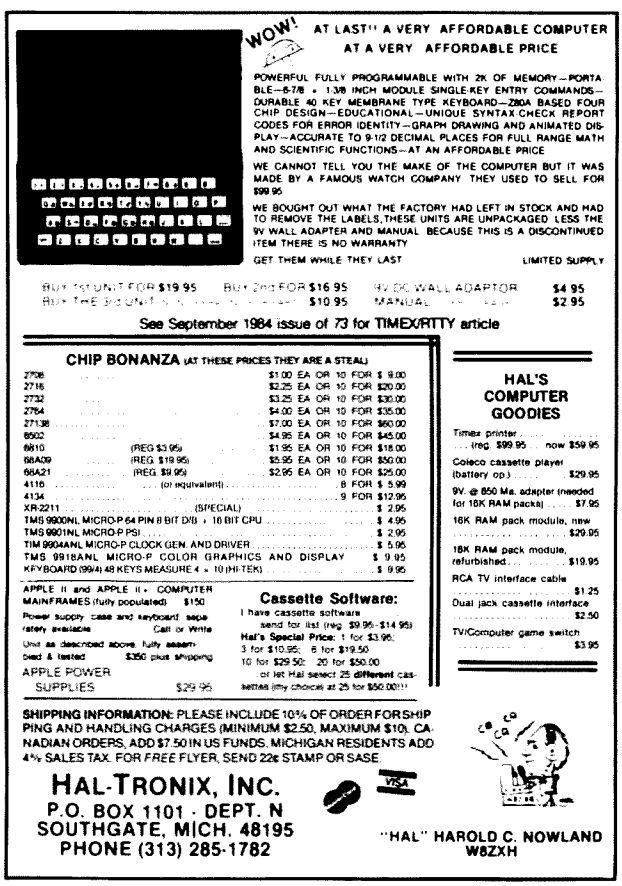
The primary winding of T1 now becomes the modulating choke; through it flows the anode current of both triodes (Heising modulation). R3 feeds a bit of signal to the phones for sidetone. Switch section S2D connects the grid of the right triode to microphone transformer T2. The microphone is of the carbon type that requires a dc current. This comes from the 3-V battery and flows via the primary winding of T2, switches S3 and S2C, and via the mike back to the battery.

Negative bias for the audio triode is provided by resistor R4, shunted by C10 for audio frequency signals. Return current from the 135-V battery flows through R4 and so provides a voltage that is negative with respect to ground. Instead of telephony, tone-modulated telegraphy could also be used with the radio (mode A2A, formerly A2). For this mode, the microphone circuit is opened by S3 (in Photo C visible above the transmit/receive switch). The Morse "key" is the black, round knob to the right of the transmit/receive switch in that photo. When the key is worked, the key contact connects the secondary of T1 to C8 and C9, as shown in Fig. 4. This causes af feedback and the right triode generates an audio-frequency note that modulates the transmitter.

Mechanical Construction

The radio is built like the proverbial battleship. As the pictures show, every component is bolted to the frame. Each part carries a number that is also used in the circuit diagram and the parts list on the inside of the lid. Obviously, the designers had servicing very much in mind.

The radio slides into a metal box. How this was carried is not clear, but most likely it was in a canvas cover with the necessary straps for slinging it over the shoulder or fastening to the soldier's belt. As Photo A shows, the generator has a canvas strap. Not shown are pairs of metal hooks that slide outwards at the bottom of the generator. These obviously are meant for hooking the machine to the belt—one pair for the right-handed soldier, the other for the left-handed one. Cranking the generator is not an easy job—so transmissions will be kept brief! ■



John M. Franke WA4WDL
1310 Bolling Avenue
Norfolk VA 23508

Halt That Hum!

That annoying ac hum is robbing you of pleasure. Fix it in an hour with WA4WDL's seven-piece filter.

Believe it or not, everybody does not use solid-state, twelve-volt-compatible equipment even in these modern times. I have an old surplus ARB receiver that I use to listen to the short-wave bands. I especially enjoy *The World Service* of the BBC. The receiver has vacuum tubes, and I know several other SWLs/hams who still use vacuum-tube receivers for similar entertainment. Recently, I got bitten by the RTTY bug and began looking at TU (terminal unit) designs.

The first thing I did was to look at the audio output from the receiver to determine such things as noise level, signal levels, and so on. My biggest surprise was the hum level; it was almost as large as the audio signals. Apparently, my poor low-frequency hearing response and the poor low-frequency response of the four-inch speaker combined to reduce the hum to an acceptable level. A couple of other tube-type receivers were checked. The hum level ranged from my high to about one-tenth the normal audio level.

Once we were all aware of the problem, the hum became unbearable—ignorance is bliss! Fine, all you need to do is increase the high-voltage filter capacitors. This was considered easy until after I had clipped in 200 microfarads to get the hum down to a reasonable level. There had to be a better way. The solution was to build an electronic hum eliminator.

The hum eliminator works like a poor man's voltage regulator. A normal series pass regulator, as in Fig. 1(a), consists of a series pass transistor and a reference voltage. The transistor operates as an emitter follower and the output voltage is simply the reference voltage minus one base-to-emitter voltage drop. The hum eliminator replaces the reference voltage with a resistive voltage divider and a filter capacitor; see Fig. 1(b).

The output voltage is now equal to the input voltage times R2/(R1 + R2). The base-to-emitter drop is ignored. So what good is it? The answer lies in the addition of the capacitor. Without the capacitor, the output voltage would follow the input voltage and the percent of ripple present would not be changed. The capacitor removes the ripple from the base voltage and thereby from the output.

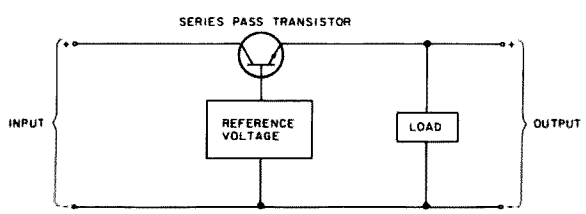


Fig. 1(a). Simplified series voltage regulator.

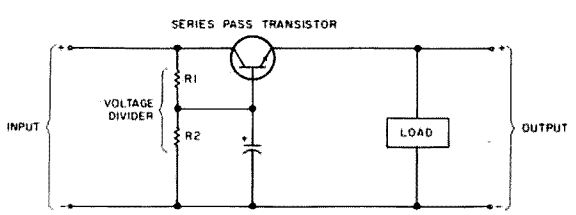


Fig. 1(b). Simplified hum-eliminator circuit.

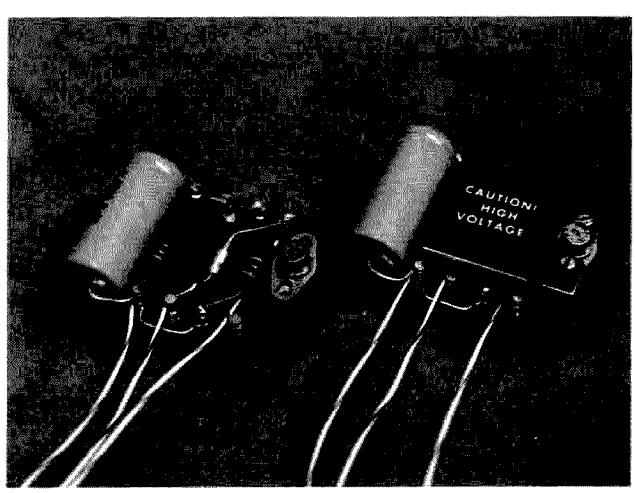
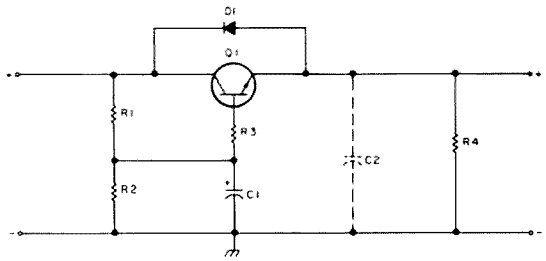


Photo A. The electronic hum eliminator.



SYMBOL	VALUE	FUNCTION
R1	13K, 1W	VOLTAGE DIVIDER
R2	100K, 1W	VOLTAGE DIVIDER
R3	270Ω, 1/2W	PARASITIC SUPPRESSOR
R4	120K, 1W	BLEEDER
C1	20μF, 450W V	FILTER
D1	600V, 1A (IN3191)	REVERSE VOLTAGE PROTECTION
Q1	SEE TEXT	SERIES PASS TRANSISTOR
C2	.01, 600V	BYPASS (OPTIONAL, SEE TEXT)

Fig. 2. Schematic of the hum eliminator.

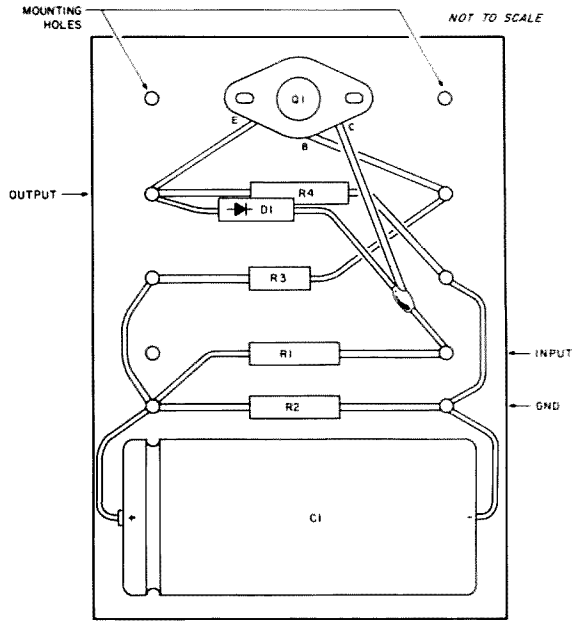


Fig. 3. Pictorial layout of the hum eliminator.

The success of this circuit relies on the difference in time constants in the power supply and the hum-eliminator base circuit. The receiver power supply has a dynamic impedance of about 400 Ohms. The impedance seen at the base of the transistor is roughly R1 in parallel with R2. If we make the parallel combination of R1 and R2 about 10,000 Ohms, the base filter capacitor is 25 times more effective than the same capacitor placed across the input.

Not bad, huh? But this is not free. The output voltage is less with the hum eliminator due to the division ratio of R1 and R2. R1 and R2 should be chosen so that the final output level is less than the input voltage minus the ripple. Otherwise, the series pass transistor will be reverse biased and possibly destroyed.

The actual circuit used is shown in Fig. 2. Note that it is slightly more complicated than that shown in Fig. 1(b). First, a diode has been added across the series pass transistor to prevent reverse biasing. Second, a 270-Ohm resistor has been added to the transistor base circuit. The resistor eliminates parasitic oscillations from the otherwise common base amplifier formed by the addition of the filter capacitor. R1 and R2 were chosen to produce a 25-27-volt drop across the transistor. Since the input ripple was only 10 volts under load, the drop is sufficient. The output ripple is now less than .05 volts and the hum on the audio output is not discernible on my scope or with my ears.

The output transistor should be rated for at least one and a half times the no-load input voltage. Also, the transistor must dissipate the peak current through it times the peak voltage across it. For my receiver, this works out to be 27 volts times 60 milliamps, or 1.62 Watts. I used a 2N4063 because it was available and mounted it on a small heat sink.

C2 is optional and was not needed for every unit. It prevents oscillation when the output leads are excessively long. It is cheap, and eventually I added one to each of my units.

The units were constructed on small terminal boards with staked terminals. Fig. 3 is a pictorial layout of the circuit before C2 was added. Photo A shows two units, one with the heat sink installed and one with the

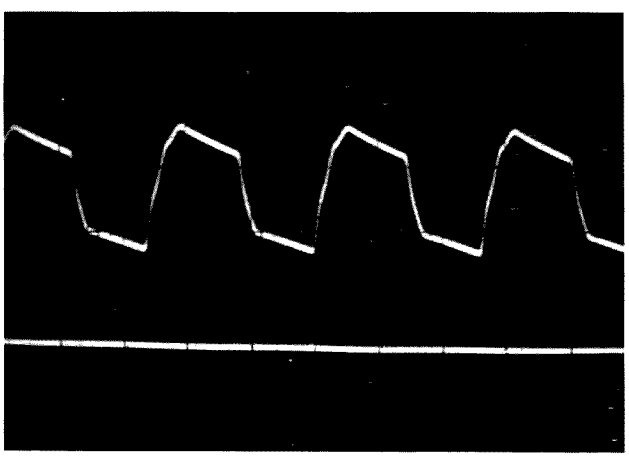


Photo B. Ripple reduction.

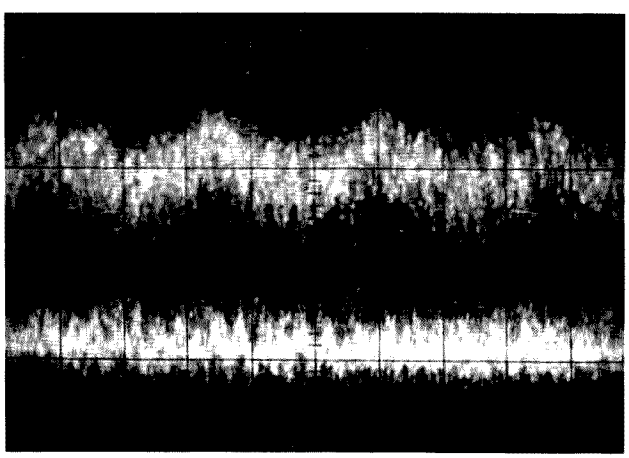


Photo C. Hum reduction, high volume.

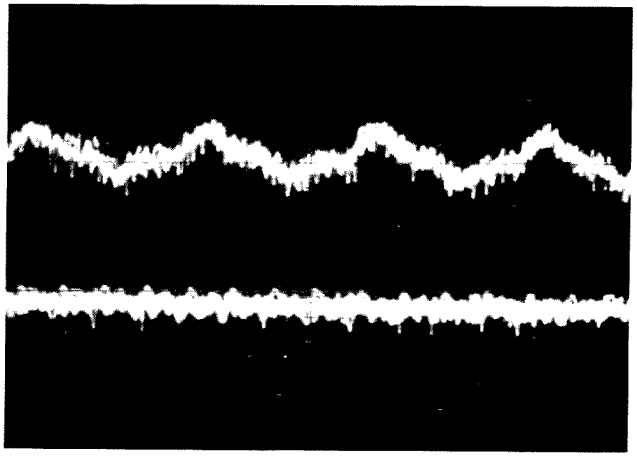
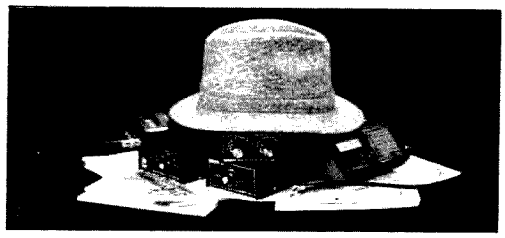


Photo D. Hum reduction, low volume.

heat sink removed to provide a better view. The scope waveform photos show the improvement with this circuit. Photo B shows the ripple reduction. The upper trace, 5 V per cm, was the original ripple level. The lower trace, also 5 V per cm, is the present ripple level. Photos C and D show the hum reduction on the audio output for high and low volume outputs. In each photograph, the upper trace is the before case and the lower trace is the present case.

Now I can go back to looking at TU designs, and soon, hopefully, I will be copying RTTY signals as well as enjoying listening to the BBC with a much improved receiver. ■

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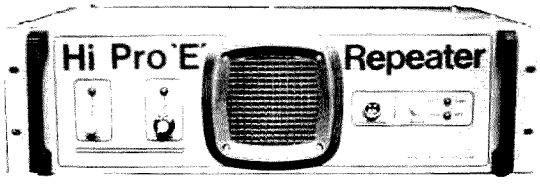
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It's Friday afternoon. You're caught in heavy rush-hour traffic. You're going to be late getting home. It would be nice to punch up the patch and advise your wife to adjust dinner time, but do you dare risk dialing in this traffic? Sure! If your rig is equipped with this speed-dial circuit, your eyes never have to leave the road. This article describes circuitry which allows a telephone number to be dialed at high speed by simply pushing a single button on the microphone.

Most hams that operate FM mobile are sooner or later faced with a dilemma—we feel the need (or urge) to use the autopatch while driving. The need is not urgent enough to pull off the freeway or busy street and park, and trying to manipulate a DTMF pad while driving is certainly not worth the risk. And yet, it really would be nice to make that call. I have found myself in this situation many times. This was the reason behind the development of this speed-dial circuit.

There is another benefit gained from using this speed-dial circuit. When the dial button is pushed, the phone number is transmitted at a rather fast rate. The entire seven-digit sequence takes only about one second. This means that each burst of tones lasts only about 65 to 70 milliseconds (there is a silent space between tones). The shorter the burst length, the lower



Photo A. The speed-dial switch mounts on the side of the microphone near the area where the remote volume control used to be. A protection ring around the dial button eliminates any accidental dialing sequences while handling the microphone.

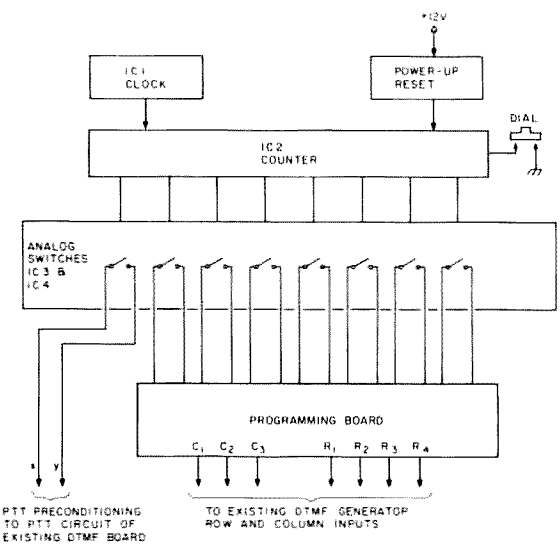


Fig.1. Block diagram of the speed-dial circuit.

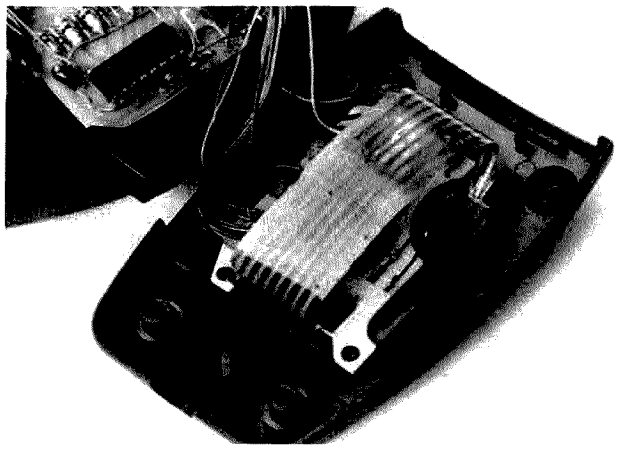


Photo B. In the newer-style microphone (Model PCM-369), capacitor C3 must be changed to a physically smaller tantalum type. Leave its leads long and let it hang over the edge of the board. The older-style PCM-2000 microphone does not need this change.

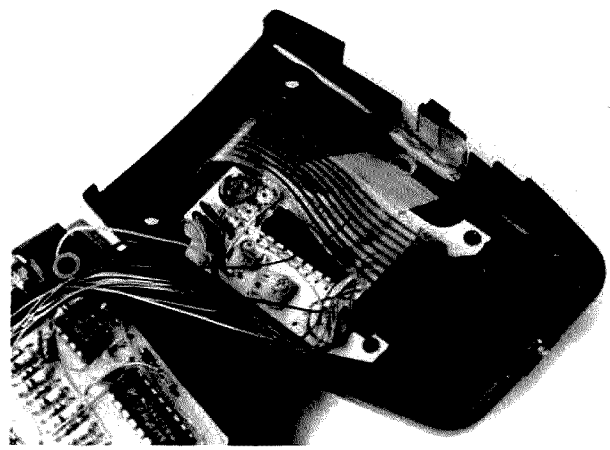


Photo C. In the PCM-369 microphone, the row-and-column leads are connected to the existing solder pins of the plastic bus connector. Route the wires underneath the flat printed-bus cable. Be careful not to burn or melt this printed bus or the connector when soldering in this cramped area.

the probability that rf flutter or "picket-fencing" will cause the telephone equipment to see a double digit. Hence, this speed-dialed number tends to be more accurate than a hand-dialed number lasting hundreds of milliseconds per digit

Limitations

Unfortunately, in order to fit the parts inside the already-stuffed microphone case, certain sacrifices had to be made. There just wasn't enough room for memory chips and their associated parts, so this dialer can hold only one phone number—presumably your home phone, or one that you call regularly. This number is programmed with tiny wire jumpers and is changeable in about ten minutes with a soldering iron. An advantage of this type of "memory," in addition to saving space, is that it is guaranteed not to forget when powered down!

A preconditioner for the PTT would have been nice—a circuit that brings up the transmitter and gets the squelch open on the repeater receiver before the phone number is dialed. Again, space limitations won out over bells and whistles, and because of that, I recommend that you squeeze the PTT bar just prior to pushing the dial switch. I did design in *some* PTT preconditioning, using what limited space I had. The circuitry keys the transmitter about 200 milliseconds prior to the actual dial sequence. Sometimes, however, that is still not quite enough time to bring up the transmitter and open the receiver squelch circuits in time to hear the first digit dialed. As a general rule I would recommend that the PTT bar be squeezed first, just to be safe. This is really much easier to do than it sounds, and can be done quite nicely with just one hand while leaving your eyes on the road and traffic.

This circuit was designed and physically tailored to fit inside my Azden DTMF microphone. However, the circuit is electrically compatible with any DTMF encoder using row-and-column inputs. This includes virtually all of the current encoder circuitry on the market today. If you happen to own an Azden microphone, then you're home free, as I have included a full-size printed-circuit-board layout for this project which will fit into either of the Azden microphones supplied with their earlier transceivers.

It is important to point out that although this article is concerned with mounting circuitry inside a microphone, this is only necessary when the DTMF encoder and touch pad are also mounted in the microphone. The speed-dial circuit must be installed where it has access to the row-and-column inputs of the DTMF encoder chip. In cases where the touch pad is panel-mounted on the radio, the speed-dial circuit would be installed inside the transceiver.

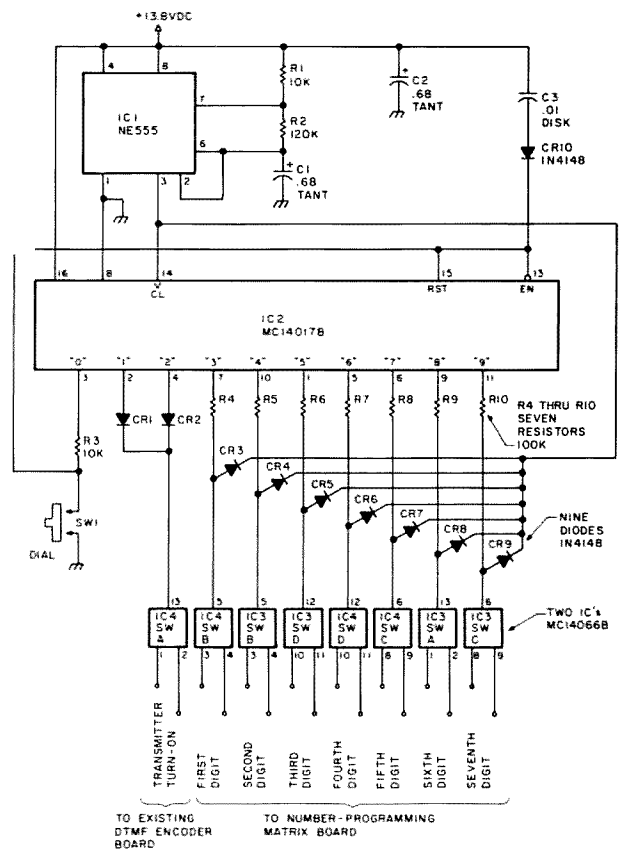


Fig. 2. Schematic of the speed-dial circuit.

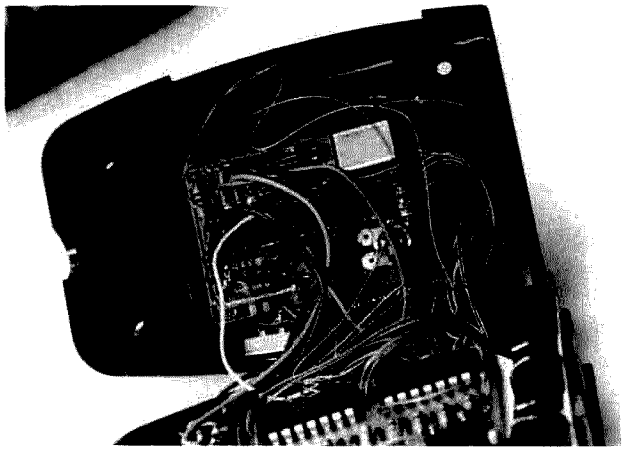


Photo D. In the older-style PCM-2000 microphone, the row-and-column leads are soldered to existing PC pads on the end of the DTMF board. The crystal must be bent up slightly while soldering. Use just a small amount of heat and do not disturb the existing wires which are poking through these pads from below the board.

I have installed this circuit inside two different Azden microphones. One was supplied with the Azden PCS-2000, and the other was supplied with the PCS-3000. These two microphones are physically the same basic unit. Note that Azden radios having serial numbers prior to 53752 require microphones with a battery inside. Because of the limited space in this case, the circuit will probably not fit inside that microphone without changing the physical layout of the parts. I have not attempted to install this circuit in one of those early microphones.

One of the microphones I did modify uses a DTMF encoder, model CSTTK-1, made by Communications Electronics Specialties, Inc. The encoder comes fully assembled in a replacement back for the microphone, and uses a chip, part number S2559C, made by American Micro-Systems, Inc. In general, if your Azden transceiver is a PCS-2000, you will have this type of microphone.

The other microphone I modified included the DTMF generator as a kit (included in the purchase price of the Azden PCS-3000). This unit has a differently-shaped encoder board, a smaller touch pad, and uses a chip made by Mostek, part number MK5087N. The front of this microphone is labeled PCM-369. In general, if your Azden transceiver is a PCS-3000, you will have this type of microphone.

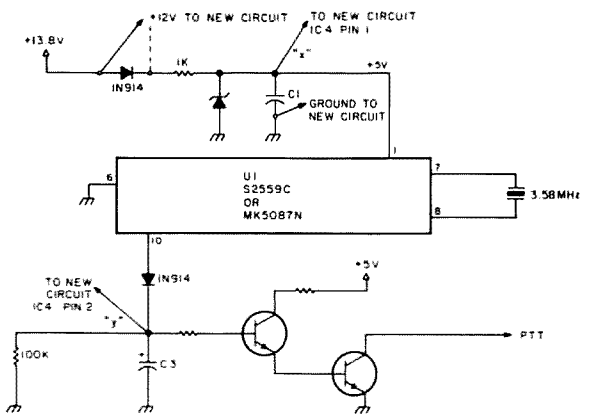


Fig. 3. Partial schematic of the existing DTMF encoder showing points of connection to the new circuit.

Functional Description

Briefly, this circuit consists of a decade counter driving a set of eight isolated switches in sequence, as shown in Fig. 1. Each switch connects a row to a column on the DTMF generator, just as the actual touch-pad switch does when the operator presses it. These switches are normally all off and the counter is in a reset or hold state. When the dial switch is pressed, the counter sweeps through its sequence, turning each switch on, then off. As each switch connects a row to a column input, a pair of tones corresponding to that digit is generated and transmitted just as if the proper switches on the touch pad had been pressed.

Fig. 2 shows the schematic of the speed dialer. IC1 supplies the clock signal for IC2, a 5-stage divide-by-10 Johnson counter with 10 decoded outputs. As IC2 counts, each of its ten outputs goes high sequentially, starting at pin 3 and going on through pin 11, and then back to pin 3. When IC2 is reset (by pin 15), pin 3 is forced high immediately and all other outputs are forced low.

On power-up, C3 and CR10 pass a positive pulse to pin 15, which resets the counter. Pin 3 immediately goes high and is fed back to pin 15 via R3 to hold it in the reset state. This high is also fed to pin 13, which holds the counter disabled from the free-running clock at pin 14. This is the state that the counter remains in until called on to dial a number.

When the dial switch is momentarily pressed, IC2 pins 13 and 15 are pulled low. This enables the clock, and the counter begins its sequential pulse train. As soon as the first clock pulse is registered, pin 3 goes low and the dial switch can be released. This all happens within about 100 milliseconds. Thus the chip is held enabled and counting by its own pin-3 output (low) until it goes through all ten outputs and cycles back around to bring pin 3 high again. At that time, this high disables the counter and locks the chip in its "hold" mode again.

Now let's see what happens as the counter sequentially outputs highs. Each of these outputs is fed in turn to either IC3 or IC4. These chips contain MOSFET bilateral switches. Each one of these switches is like a tiny relay with normally-open switch contacts. When the input goes high, the switch closes. These switches are really very good—opened they have less than 200 picoamperes leakage, and closed resistance is typically less than 80 Ohms.

The first output, pin 2, is fed via CR1 to switch A. This switch is part of the PTT preconditioning mentioned earlier. The output is connected to the existing DTMF board, supplying +5 volts to the base of the PTT driver transistor. This connection is shown as points X and Y in Fig. 3. When the switch closes, it keys up the PTT

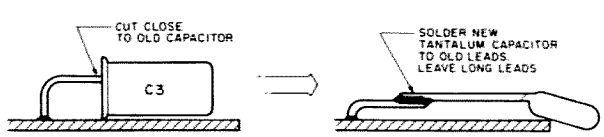


Fig. 4. For the PCM-369 microphone, replace C3 with a smaller tantalum capacitor. Leave long leads and let it hang over the edge of the encoder board.

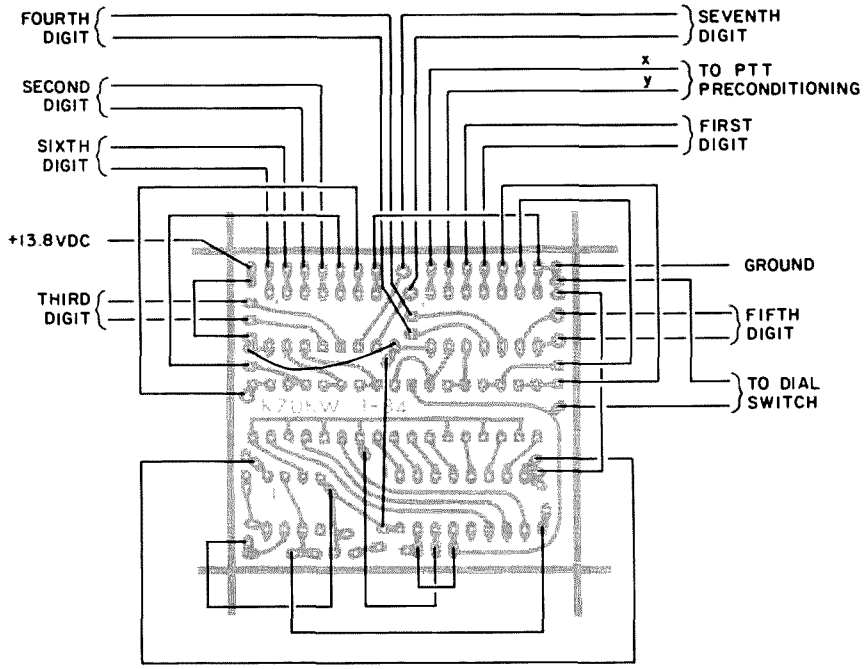


Fig. 5. Layout of the main board, shown from the foil side, detailing jumpers and interconnect wires.

and charges the PTT holding capacitor (C3, Fig. 3), which holds the PTT on until the next high from IC2 pin 4. This high from IC2 pin 4 is also fed to IC4 switch A, via CR2, which keeps the PTT on and again charges the holding capacitor. The net effect of all this is to give the transmitter a 200-millisecond head start before the tones are actually generated. This helps get squelch circuits opened prior to the actual dialing of the number.

The rest of the operation is very straightforward. As each output goes high, its associated switch is closed. This switch is tied across the row-and-column input for that digit. When the switch closes, the tones are generated. After the last digit is generated, the counter rolls around to pin 3 again, where it stops itself and holds, waiting for the next dialing sequence.

Resistors R4 through R10 and CR3 through CR9 form logical AND gates at the input to each of the seven bilateral switches. Here the sequential highs from the counter are ANDed with the free-running clock to produce first a dual tone and then a quiet period for each digit produced. The reason for this is so the telephone equipment can distinguish between two sequential identical digits. For example, in a phone number such as 296-5114, if there were no quiet period between digits, the phone equipment would only see 296-514, with the "1" being twice as long as the other digits. Telephone equipment specifications require certain minimum-timing sequences and inter-digit pauses, and the circuitry operates within these constraints.

Some readers may wonder why I used resistors and diodes to form the AND gates instead of an integrated circuit like the CD4081. Although it would have taken up no more room on the board, the PC layout would have become much more complicated due to the input/output-pin layouts on these chips.

The phone numbers are actually developed on the little programming board, where each bilateral switch closure is jumpered to the proper row-and-column input for that particular digit in the sequence. Fig. 8 shows the board programmed for a sample number.

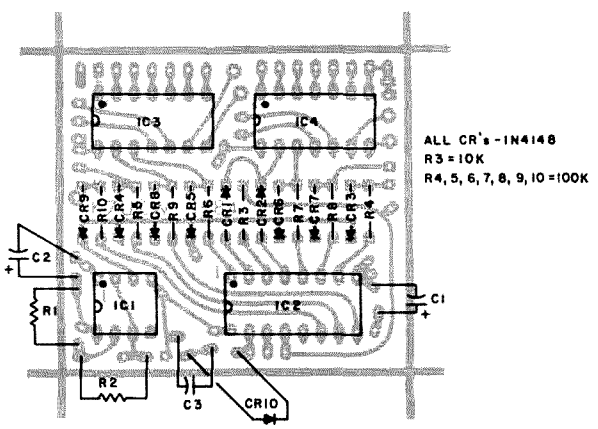


Fig. 6. Parts placement guide as seen through the board.

Mounting Considerations

In order to make this new board fit inside the Azden microphone, a few existing conveniences have to be given up. The remote volume control (and squelch control if your microphone has it) must be removed. I don't think of this as a great inconvenience because I never use them anyway. In fact, I had already traded my remote-squelch control for a reverse switch to allow monitoring of the repeater input momentarily. I kept that switch and removed the red volume knob, wrapped the volume pot in tape, and stuffed it down under the reversing switch where it was out of the way.

On the newer microphone (the one labeled PCM-369) a change must be made to the DTMF generator board. Capacitor C3, the inter-digit PTT hold-timing capacitor, must be changed from a rather fat electrolytic to a slender tantalum type and, at the same time, moved so that it hangs over the edge of the board. See Fig. 4 and Photo B. This gives us nearly an eighth of an inch more room in the cavity between the DTMF encoder board and the microphone element, allowing the new speed-dial board to fit snugly within this space.

Due to obvious space requirements, I recommend using printed-circuit-board techniques. I used a single-sided board layout rather than a double-sided layout for two reasons. Single-sided boards are much easier to make masks for, and most hobbyists shy away from double-sided work because of the extra time and effort needed for proper registration. Since I planned to

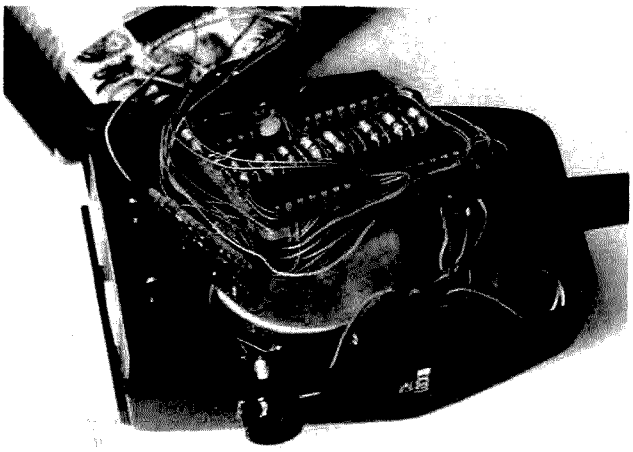


Photo E. Packing it all inside the microphone case looks impossible at first glance. The little program board slips vertically between the mike element and the two up/down switches; cover the solder side with electrical tape first. The main board then overlaps it and lies flat against the mike element, insulated with Kraft paper.

share this with other hams, I opted for the simplest technique from a construction standpoint. In the case of a small circuit like this, being constructed at home using hobby techniques, a single-sided layout using even a large number of jumpers is usually preferred over double-sided layouts.

Constructing the Circuit

When you have etched, cleaned, and drilled your boards, there are a few considerations to keep in mind while you stuff them with parts and connect the jumper wires. Use reasonably small wire for all jumpers and connecting leads. Space inside the microphone is at a premium and the smaller the wire, the easier it will be to get the case halves back together after adding this new circuit. I used AWG 30 Kynar wire-wrap wire for everything. It is very thin and the insulation is tough.

Start by installing all the resistors and diodes in the middle of the main board. Hole spacing is tight, but quarter-Watt resistors will just fit if their leads are bent tightly down against the ends of the resistor body. Pay attention to Fig. 6 and get the diodes in correctly—there are two diodes near the center of the board that are reversed from the others. Next, install all the jumpers on the main board. Fig. 5 shows these jumpers along with the other interconnect wires. Be sure to route these jumpers around the areas where the four ICs will be placed. We want the ICs to fit tightly against the board, not on top of a wire. Note that Figs. 5 and 6 are viewed from the solder side of the board. It was considered easier to locate holes from this side of the board since the top side is not silk-screened.

After soldering the connections, be careful when snipping *off* the wires on the bottom side of the board. The wire ends must be cut very short and flush to the board. If big blobs of solder and wire are left, the board will be too thick to fit inside the microphone. Be very careful to leave no sharp points either, because these could cause shorts.

Now install all of the other parts except the ICs. Fig. 6 shows their locations. Refer to the photos to bend the three capacitors. Their orientation is not critical, but the parts do have to lie flat against the board to keep the package as thin as possible.

Now it's time to mount the push-button switch on the microphone. Refer to Photos A, E, and F for the location. I found it much easier to attach two eight-inch leads to the switch before I mounted it—the excess can be trimmed off when soldering the wires to the board. Photos A and E show a raised cylinder around the actual push-button. I added this to prevent any possibility of an unintentional dialing sequence. Do not add this yet; its construction and mounting will be dealt with later.

The next step is to program (jumper) the little memory board. These jumpers can be put in last, but it is easier if the memory board is not yet connected to the main board. Again, I used AWG 30 Kynar wire. Refer to Fig. 7 and Table 1 for the placement of the program jumpers. Fig. 8 is an example; it is shown programmed for the phone number 296-1234.

When the memory board is programmed, it must be attached to the main board by the digit-enable wires. These connections are shown in Figs. 5 and 7. When cutting the wires, be sure to leave enough length to position the two boards as shown in the photos. The little telephone-number program board will mount vertically, underneath the end of the main board. The main board just overlaps the little board.

The last connections to this little board are the row-and-column inputs from the existing DTMF board. Refer to Fig. 9 if you have the older-style microphone (Azden PCM-2000). Refer to Fig. 10 if you have the newer-style microphone (Azden PCM-369). Fig. 7 shows the connections to the program board. These leads should be left long enough to allow the case halves to open flat for servicing, but not any

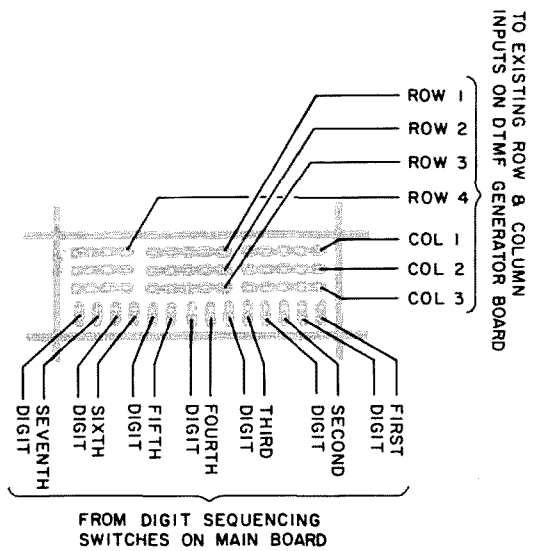


Fig. 7. Solder side of the program board, showing interconnect routing.

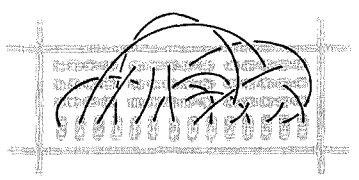


Fig. 8. A programmed memory board. The number is 296-1234.

longer than necessary. It all has to fit inside eventually!

There should now be only six holes left on the main board without wires in them—two for the dial switch, two for +Vcc and ground, and two for the PTT preconditioning circuit. Cut four eight-inch wires. Solder one end of a wire into each of the remaining holes except the dial-switch holes. Refer to Fig. 5. Let the free ends dangle for now.

Cut a piece of electrical tape and cover the solder side of the little memory board. Referring to Photo E, lay the memory board vertically between the microphone element and the up/down switches. The tape-covered solder side should face away from the microphone element. The main board should lie flat against the back of the microphone element, solder side down against the top of the microphone element. You must remove any pieces of sticky-backed foam that were used to keep the microphone element in place.

Fig. 3 shows a portion of the circuit used in the existing DTMF encoder. The circuit is *similar for* both models of Azden. Fig. 3 indicates electrical connections for the four wires previously mentioned. Depending on your type of microphone, Figs. 9 and 10 show the actual physical connections indicated in Fig. 3. Refer to the correct figure and Photos B, C, and D, and connect these four wires. Refer to Fig. 5 and connect the two wires coming from the dial switch.

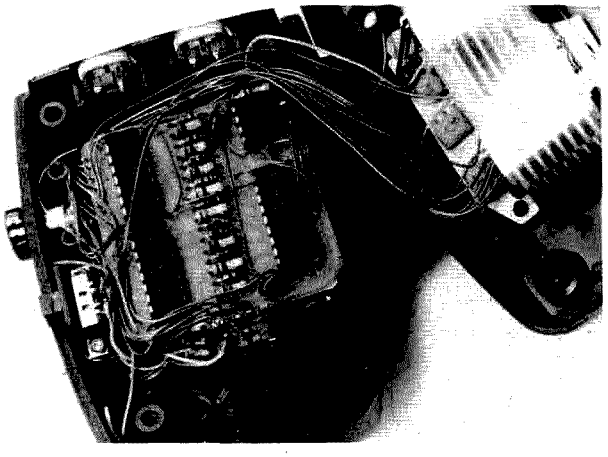


Photo F. When mounting the parts on the printed-circuit board, be sure to orient the three capacitors flat against the board—there is not enough room to allow them to mount vertically. The exact routing of the many connecting wires is not critical.

Refer to Fig. 6 and install the integrated circuits. Be careful not to handle their leads any more than necessary—use standard CMOS precautions. After soldering them in place, be sure to snip off all the sharp tips. Now cut out two pieces of heavy paper (I used index-card stock) just the same size as the main board. Slip one piece under the main board to protect the solder side from touching the microphone element. The other piece goes on top of the main board to protect its parts from touching the existing DTMF board. It might be a good idea to recheck the solder side of the board at this point for any sharp, pointed connections. These connections will work their way through the paper insulation in time and cause malfunctions when they short to the microphone element.

Checking It Out

It is a good idea to check the performance of the circuit before you go to all the effort of assembling the case halves and installing the four retaining screws. The easiest way to check it is to put the transmitter on a seldom-used simplex frequency, connected to a dummy load, and then push the dial button while listening with another receiver. You should hear the seven-digit phone number transmitted at about six to eight digits per second. It should be transmitted only once, unless you hold the dial button down.

If everything seems normal, assemble the case halves together making sure that no wires get pinched in the process. This is a fairly snug fit; it needs just a slight bit of pressure to make the case halves fit completely together. If it requires heavy pressure, or if you feel that you are having to force things, then there is something wrong and you need to check for pinched wires, unclipped solder leads, large blobs of solder on the back, parts not inserted all the way into the board, etc.

Now that the case halves are assembled together, make the on-the-air test again to make sure nothing

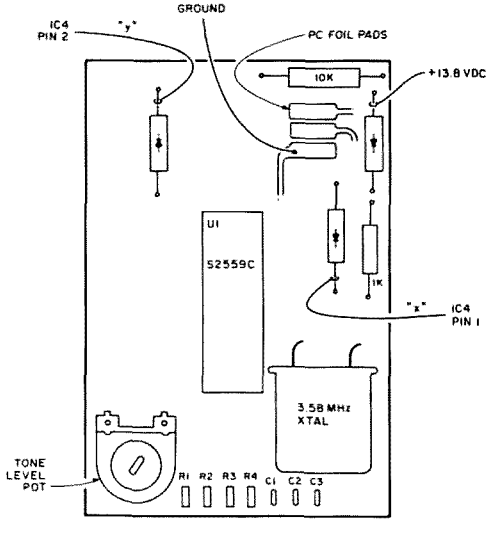


Fig. 9. The PCM-2000 DTMF generator.

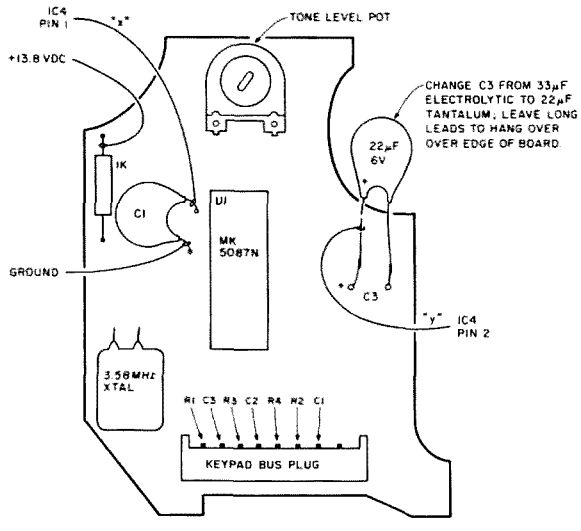


Fig. 10. The PCM-369 DTMF generator.

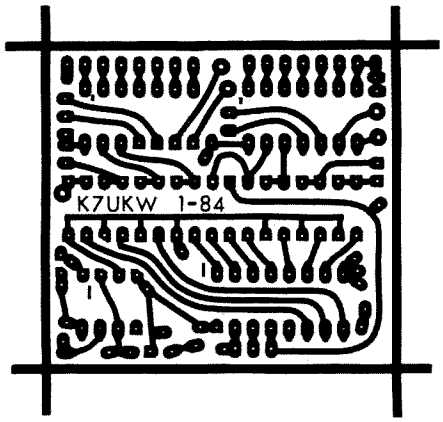


Fig. 11. Circuit pattern, full size, foil side.

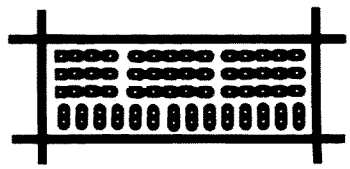


Fig. 12. Program-board pattern, full size, foil side.

got pinched or shorted. If this goes well, make a manual test of all the keys on the keypad. Another very important test to make is to check the power-up reset circuitry, C3 and CR10. Turn off your transceiver but leave the separate monitor receiver on. Now turn on the transceiver connected to the modified microphone. It should come up in the receive mode and should not transmit a string of tone digits. Repeat this several times to assure yourself that the modification will always power up in a standby mode.

The last and most important test is the on-the-air test. Call up your local patch, push the PTT bar, and tap the dial button. Make sure that it dials the number you expected. Repeat several times to be certain that it is consistent.

When you are satisfied that all is working properly, you are ready to put the finishing touches on the project. This consists of attaching a small cylinder about one-quarter inch high around the push-button dial switch. This prevents accidental dialing when reaching for the microphone or holding it in your hands. It will not allow a casual brush to trigger the switch, but an on-target finger tip can still very easily trigger the dial sequence when desired.

To Generate Digit	From Column	To Row
1	C1	R1
2	C2	R1
3	C3	R1
4	C1	R2
5	C2	R2
6	C3	R2
7	C1	R3
8	C2	R3
9	C3	R3
0	C2	R4

Table. 1. Jumper programming connections.

The material for this protection ring can be nearly anything you can imagine. I used a piece cut from the cap of a discarded Flair felt-tipped pen. After sanding the cut edges smooth, mix up some epoxy glue and attach the cylinder to the microphone case around the switch. It helps to rough up the microphone case first with a pin or sandpaper so that the epoxy can stick better. You can experiment with other types of adhesives, but the only thing I've found that will adhere to the plastic in these microphones is the two-part epoxy that you mix individually for each job. After the epoxy hardens, the ring can be painted black to match the rest of the microphone.

In Case of Difficulty

Troubleshooting and correcting problems are not too difficult if you keep in mind how the circuit operates and how it interconnects to the other microphone circuits.

If you have trouble, the first thing to do is to verify your power source. Check for +13 V dc (nominal) at IC1 form pin 8 to pin 1. Also check for +13 V dc from IC2 pin 16 to pin 8, and ICs 3 and 4, pin 14 to pin 7. This verifies the proper placement of the Vcc and ground jumpers on the board, too. I checked both circuits I made for proper operation over a varying voltage source and found them to be reliable from +8 V dc to +17 V dc. This is, of course, a much greater range than one would ever expect from an automobile system, but it perhaps will help eliminate any suspicions of malfunctions due to low (or high) battery voltage.

Check for a constant clock pulse on IC1 pin 3. This should be nominally 10 Hz. This waveform must be present as long as power is applied to the circuit. It should toggle to within at least 10 percent of the supply rails.

If a number is dialed, but it is the wrong number, first check that you can correctly dial the number manually using the built-in touch pad on the microphone. If this works properly every time you try, then the trouble must be in the circuit you have added, not in the DTMF generator or phone patch. Check to make sure that you have wired the digit-switching wires correctly between the main board and the number-program board. Refer to Figs. 5 and 7. Another possiblity is incorrect wiring between the program board and the row-and-column inputs of the existing DTMF chip. Refer to Fig. 7 and either Fig. 9 or Fig. 10 and double check. Of course, you should check the actual number programming on the little board—refer to Figs. 7 and 8, and Table 1.

Note that the telephone company has certain limitations concerning the speed at which we dial, the length of each digit, and the quiet space between each digit. Listen to your burst of digits; it should take about one second to send out all seven digits. If it takes significantly less time, you may be pushing the limits of the telephone company's equipment. Check R2 and C1 for correct values (Fig. 2).

If all these checks turn up nothing, try temporarily tacking a larger capacitor (something like 4 to 10 mF) across C1 on the main circuit board. This will greatly slow down the clock to the counter chip and allow you to follow in detail the digit generation sequence. Perhaps you can spot the trouble at this slower rate. This slower rate will also enable you to probe the output pins of IC2 during the digit sequencing to verify that IC2 is working properly. While listening to the sequence, make sure that there is a quiet period between tones of about the same duration as the tones are on. If not, check very carefully the orientation of all the diodes in the middle of the board. Refer to Fig. 6. Note that two of them are reversed from the others.

If you experience a dial sequence upon power-up, check that CR10 is not in backwards or open. Also make sure C3 is not open. If you can get no dial sequence or only part of a sequence, check that C3 is not

shorted. If the dial sequence runs over and over, suspect a shorted dial switch or connecting wires. This can also be caused by a leaky C3. Make sure the value of R3 is 10k Ohms.

If none of the above exercises seem to have helped, you must get tough and start isolating the board into sections to find where the trouble actually is.

Begin by getting the circuit into a quiescent state (not dialing). If yours already is, skip to the next paragraph. If not, unsolder the jumper wire from pin 14 of IC2. This removes the clock from IC2. Now power up the circuit and momentarily touch a wire from +13 V dc to pin 15 of IC2. This must reset IC2. Pin 3 of IC2 should now be high, and all other digit outputs (pins 2,4,7,10, 1,5,6,9, and 11) should be low.

Now turn on the monitor receiver and listen while performing the following checks. Using a 10k-Ohm resistor with one end tied to +13 V dc, touch the other end to each bilateral-switch control lead one at a time, while listening to the generated tone in the receiver. Using another DTMF generator (or a telephone held to your ear), compare the pitch of the tones and verify that the required tones are correct for each digit. For example, touch the 10k resistor to IC4 pin 5. This should key the transmitter and generate the first digit of your programmed phone number. If everything goes well here, then the program board, the bilateral switch ICs, and the connecting wiring are OK.

You can then proceed backward through the circuit, isolating each chip and verifying if it is doing what it is supposed to do. For example, with a valid clock input to IC2 pin 14, IC2 should count from 0 to 9 on each rising clock pulse. As each output goes high during its count, all other outputs must go low. This can actually be checked with a meter if the clock is slowed down sufficiently with a swamping capacitor as described earlier. When output 0 goes high, this high should be fed around through R3 to pins 15 and 13. This should clamp the chip at reset and disable the clock from any more counting.

All of this troubleshooting advice may seem a little intimidating and, in fact, is probably not really necessary. I have had no trouble at all with either of the circuits that I have built. If good quality parts and reasonable care in construction are used, you should be able to gleefully skip over all this dry, pessimistic troubleshooting information. But if that bug does find its way into your project, its nice to have a little guidance for locating the rascal.

Parts List

C1, C2	0.68-μF, 25-V tantalum	Jameco TM.68/35
C3	0.01-μF, 50-V disc ceramic	Jameco DC.01/50 or RS 272-131
C4*	22-μF, 6-V tantalum	Jameco TM22/6
CR1-CR10	1N4148 or 1N914 diode	Jameco 1N4148 or RS 276-1122
IC1	NE555V	Jameco NE555V or RS 276-1723
IC2	MC14017 or CD4017	Jameco CD4017 or RS 276-2417
IC3, IC4	MC14066 or CD4066	Jameco CD4066 or RS 276-2466
R1, R3	10k, 1/4 Watt, 5%	Jameco 10k-1/4W or RS 271-1335
R2	120k, 1/4 Watt, 5%	Jameco 120k-1/4
R4-R10	100k, 1/4 Watt, 5%	Jameco 100k-1/4 or RS 271-1347
SW-1	Submini SPST NO momentary switch, RS 275-1571	
Misc.	Printed-circuit materials, 30-gauge Kynar wire, epoxy glue, etc.	

*Note: C4 is used only if your microphone is the newer style PCM-369. See text.

Kynar wire is available from both listed sources.
Jameco refers to
Jameco Electronics
1355 Shoreway Road
Belmont CA 94002

RS refers to
Radio Shack
a division of Tandy Corp.

Using the Circuit

A good many of the local telephone autopatches in use today are simple, open machines that use a star (*) to bring them up and a pound sign (#) to shut them down. The autopatch for which I designed this circuit works that way, too. In this case, there is truly no reason to ever take one's eyes off the road to use the patch. The star (*) button is easy to find by feel, and a short burst after a proper ID is all that it takes to hear a dial tone. Once the dial tone is verified, a short squeeze on the PTT bar coupled with a fingertip tap on the dial button initiates the dialing sequence. Make sure that you release the PTT bar and dial button after no more than a half second—just a tap is all that it takes. If you hold the button in for more than about one second, you may trigger another burst of dialing. This won't generally bother the telephone equipment, but it sounds rather unprofessional over the air.

When your transceiver returns to the receive mode, you will either hear the phone ringing or a few seconds of clicking and then the ring-back, depending on how modern your local central office is. Our central office has not yet been upgraded to ESS (electronic-switching system) equipment, so all of the DTMF tones we dial have to be slowly converted to rotary-dial pulses before being fed into the phone equipment. That is the reason for the two- or three-second pause before the ring-back is heard. The reason that I mention this is because you normally don't hear it. This is because by the time you have manually pushed all the touch-pad buttons for your call (a relatively slow process), the tone-to-rotary conversion (if required in your exchange) has been nearly completed. When you stop dialing and listen, usually all that you hear is the last few clicks and then a ring-back.

When you dial with this speed-dial circuit, however, the tones are sent out so fast that only the first one or two digits have been converted by the time your receiver kicks back on. Hence you hear a relatively long (three to six seconds depending on the phone number) period of either silence or dialing clicks before the phone begins ringing. I mention this only so those individuals who are not familiar with the phone system won't panic or wonder if they got a wrong number before the phone finally rings.

Of course, when your call is finished, bringing the patch down is just as simple. The pound sign is easily located by feel and a quick jab is all it takes, followed by your call and any necessary logging. This can all be accomplished without ever taking your eyes away from traffic. If your local patch requires a security number to bring it up, rather than a simple star then, of course, this will require a brief glance at the touch pad. But the concentration and viewing required for dialing the actual phone number has been completely removed by this speed-dial circuit. ■

Don't Be A Kamikaze!

The Hara-Kiri Box is an improvement on the suicide cord that's still dangerous, but it's a lot safer than the cord.

Larry C. Ledford KA4J
553-4th Street SE
Cleveland TN 37311

Few hams will admit that they are foolish enough to use a suicide cord—a line cord with two alligator clips that is used to apply 110 volts ac for testing a transformer or motor. While it is very unhandy to properly set up a test jig to apply power for the testing of a component, it is equally unhandy to complete a project only to find that a component is defective or unsuitable (and have to replace it with a component of a different and often larger size).

The use of a suicide cord will tell you if the item is usable, but can kill in the process. You reach over to plug the cord in as one of the leads comes loose, and when you reconnect it, *zap!* your body becomes a conductor between the clip and the concrete floor.

The Hara-Kiri box is an improvement on the suicide cord that still is dangerous, but far safer than the cord. It is a unit that will allow you to apply power to a component momentarily or for extended periods of testing. It is protected from shorts by an automatically-resettable circuit breaker and has two indicator lights to warn if power is on or available. Both sides of the line are switched to protect you. When any two of its three switches are in the Off position, no voltage appears across the test clips or between either of the test clips and ground.

The only exotic component used in the Hara-Kiri box is the circuit breaker. This is a four-for-a-dollar hamfest item which apparently was surplus from a manufacturer of battery chargers. It looks like a large neon bulb. If you can't find one, use a 1-3-Amp fuse and holder.

Construction is standard except for the preparation of the test leads. The end of the zip cord is separated for about three inches with one side cut one inch shorter than the other. This is done so that if the clips should slip off the component under test, they cannot touch each other and cause a short. Due to the flexibility of the wire, they can be brought very close together. Should one clip come undone, the resiliency of the zip cord will spring it away from the other clip. Be sure to use the insulating boots on the alligator clips.

Label the switches as follows:

S1 Mains Off
Mains On
S2 A Steady On
S2 B Off
S2 C Push Switch
S3 Push On
I1 Mains On
I2 Live

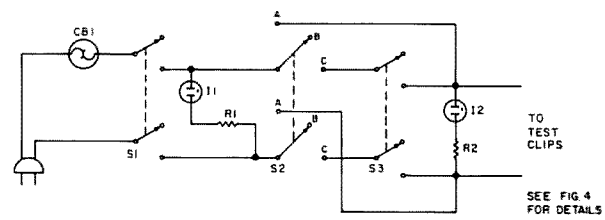
Also put a label stating: "Caution! Dangerous Voltge." My box also carries this warning: "Be Careful! Death Is So Permanent."

S1	S2 Position	S3	I1	I2	Ohmmeter Reading
Off	Off (B)	Off	Off	Off	0
On	Off	Off	On	Off	0
On	Steady (A)	Off	On	On	110 V ac
On	Push Switch (C)	Off	On	Off	0
On	Push Switch	On	On	On	110 V ac

Fig. 1.

S1	S2 Position	S3	Ohmmeter Reading
Off	Any	Off	High Ohms
On	B (Off)	Off	High
On	A (Steady On)	Off	Low Ohms
On	C (Push Switch)	Off	High
On	C (Push Switch)	On	Low Ohms

Fig. 2.



Note: all switches shown in the off position.

Fig. 3. Schematic.

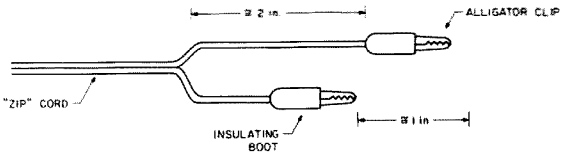


Fig. 4. Preparation of the test leads.

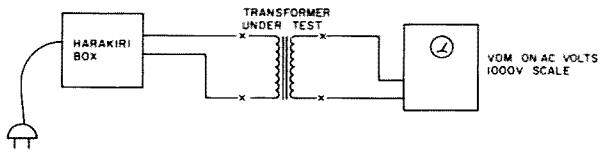


Fig. 5. Setup for using the Hara-Kiri box.

After you have finished wiring the box, it's important to run a series of tests to ensure that the box is safe to use. With the line cord disconnected from 110 V ac, connect the test clips together. Connect a VOM (in the Low Ohms position) across the blades of the line-cord plug. You should refer to Fig. 1 when operating the switches.

Any departure from the readings in Fig. 1 indicates either a defective switch or miswiring. Correct before continuing. If the readings are OK, then connect the VOM between one of the blades of the plug and one of the test clips. Since we are switching both sides of the line, there is a 50-50 chance that one of the VOM's leads will be connected to the wrong side. So if you can't get an indication on the ohmmeter, move the VOM lead to the other blade. Go through the switch sequences in Fig. 1. Readings should be the same. If they are, move the VOM leads to the other blade and the other VOM lead to the other test lead. Again, repeat the test sequence. If all is normal, then test for leakage between either of the plug blades (test one at a time) and the "bats" of the switches and the case (if you used a metal one). There should be no leakage.

Now give it a smoke test. Set the VOM for a 150-V-ac-or-more scale. Turn S1 off. Connect the test leads to the VOM. Plug the box into 110 V ac. You should have the readings in Fig. 2 on the voltmeter and indicator lights.

Turn S1 and S2 to the Off position. If the box has passed all the tests, it is now safe to use. While it may seem redundant to give this simple circuit this many tests, remember we are working with the one component that we cannot get an exact replacement for should we ruin it—*you!*

Using the Hara-Kiri box is simple and hopefully safe. Let's go through the procedure for testing an unknown transformer, which seems to be the component that I test the most often: Switch S1 (Mains) off. Switch S2 off. Plug the box into 110 V ac. For maximum safety, the box and the transformer should rest on an insulated surface. Connect the primary leads of the transformer to the test leads of the box. These are usually color-coded black. Place the VOM on the 1000-V-ac scale. This will protect the meter if the transformer has a high-voltage secondary.

Connect the VOM test leads to the transformer secondary. The leads of the VOM should have insulated alligator clips. It defeats the purpose of the box for you to hold on to the dangerous part of the circuit while applying power to it. Turn S1 on. I1 should light. Turn S2 to C (Push Switch). Push S3. I2 should light and the VOM should indicate some voltage. Release S3 and move the VOM to a lower scale for easier reading if necessary. Push S3 and note the reading. Release S3 and record the voltage of the secondary. Repeat for any other secondary windings.

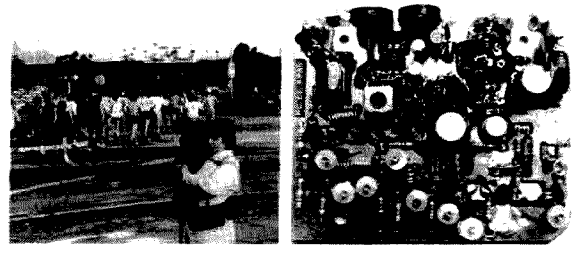
For continuous use, switch S2 to the A (Steady On) position. If I1 should go out while testing, then either the transformer is shorted or a short exists across the test leads. The circuit breaker has tripped. Switch S2 to the Off position and wait for the breaker to recycle; when it does, I1 will light up. When you are through using the box, turn S1 and S2 to the Off position.

The name Hara-Kiri is a dark humorous reference to the Japanese custom of ritual suicide, for which surely the box will not be used. The purpose of the box is just the opposite, to use a dangerous voltage safely. Always switch it off when not in use. The gradual change to transistors, with their lower voltages, may have lulled us into a position where we have lost our respect for dangerous voltages. ■

Parts List

CB1	3–4-Amp circuit breaker, automatic-reset type
S1	DPDT toggle switch
S2	DPTT toggle switch
S3	DPST or DPDT push-button switch with spring return
R1, R2	47–100k Ohms, ½ Watt
I1, I2	NE-2 neon bulb
Line cord	
3–4' of zip cord	
2 alligator clips with insulating boots	
Metal or plastic (preferred) case 2" × 4" × 6"	

AMATEUR TELEVISION



KPA5 1 WATT 70 CM ATV TRANSMITTER BOARD

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- **FULL COLOR VIDEO & SOUND** on one small 3.25x4" board.
- **RUNS ON EXTERNAL 13.8 VDC** at 300 ma supply or battery.
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- **2 AUDIO INPUTS** for a low Z dynamic and line level audio input found in most portable color cameras, VCRs, or home computers.
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132 Extra Memories for Your FT-107M

At three cents apiece, why not?

One of the very few operating inconveniences of the FT-107M is the necessity to change the memory switch when changing bands, unless you're lucky and the last 4 digits of the frequency coincide. This is the result of the storage system used by the transceiver. Internally, the memory unit counts the vfo frequency and stores the last four digits into 4 CMOS memories. When you use (recall) a frequency from this memory, a synthesizer contained in the memory unit replaces the vfo and synthesizes the frequency stored.

If you were operating, for example, on 7.1505 MHz, the memory unit stores only the last four digits (1505). Switching bands to 15 meters you get 21.1505 MHz on the display. On 10A you'd get 28.1505 MHz, etc.

Recently, while repairing a friend's FT-107's memory unit, I found that four of the 5101 memory chip's address lines are not used. Of the total of eight lines, only four are used to select the memory channel number; the other four go to +5 volts through 2.2k pull-up resistors. Reasoning that four extra lines give 16 extra possibilities, and needing only 12 (12 bands), there was the solution, ready to use.

The Circuit

The easiest way to code 12 bands (160, 80, 40, 20, 15, 10A, 10B, 10C, 10D, Aux1, Aux2, and JJY, the latter three having been modified for the new 30-, 17-, and 12-meter bands) into four lines is using a diode matrix. I wanted to use as few diodes as possible so I made up Table 1 first.

There's one code that doesn't use a diode, 4 codes that use 1 diode, and 6 codes that use 2 diodes. That totals 11, indicating the necessity to use one code with 3 diodes. Total diodes used in the coder: 19. The diode matrix is shown in Fig. 1.

The bandswitch is connected to a +8-volt supply, and the memories work on a separate +5 volts. A voltage translator was needed to convert the voltages and to isolate any possible timing problem between both supplies. A simple transistor inverter was chosen. No collector resistors are needed, as they are supplied by Yaesu in the form of the 2.2k pull-ups (Fig. 2).

Construction

When doing any work inside the transceiver, switch power off and take the plug out of the wall socket, both for the safety of the operator and the integrated circuits.

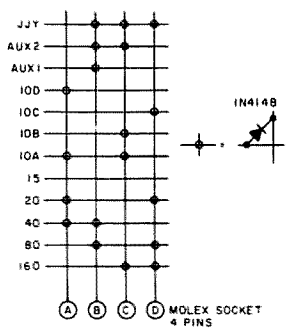


Fig. 1. Diode matrix.

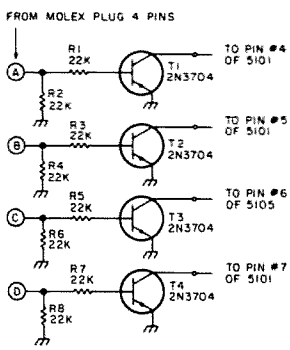


Fig. 2. Inverter/level translator.

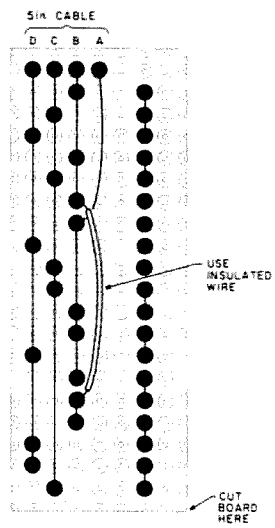


Fig. 3. Diode-matrix wiring pattern, foil side.

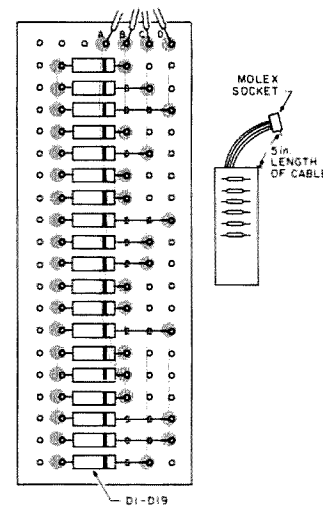


Fig. 4. Diode-matrix construction, component side.

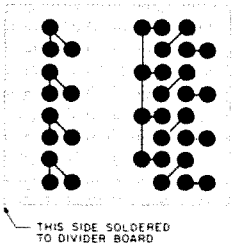


Fig. 5. Inverter/level translator board, foil side.

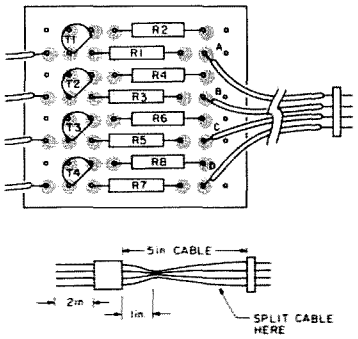


Fig. 6. Inverter/level translator board, component side.

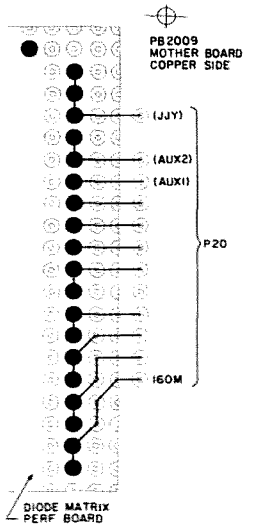


Fig. 7. Diode-matrix board pinout.

Both circuits were constructed on .1" perforated PC board (Veroboard or similar). Mount the diodes as in Fig. 4 to allow easy installation afterwards. Connect the cable to the board before mounting it inside the transceiver. On the inverter board, mount the transistors as close to the board as possible, or the board won't enter into the memory unit. Do connect the cable to the inverter board, but *without* the plug (you will have to pass the cable through one of the holes of the memory unit's enclosure first). Split this cable in two pairs.

Length of the wiring is of no great concern, but the construction as shown in the Figs. is probably the easiest.

Installation

In order to install both boards it will be necessary to remove both the top and bottom covers of the FT-107M (8 screws each). First remove the handle (2 screws).

The diode matrix fits on rf mother board PB-2009 (bottom side of the FT-107M) alongside the solder points of P20. On this plug, all the bandswitch points are available (see Fig. 7). When all the connections between the diode matrix and P20 are made, the construction is rigid enough to stay put without any other mechanical support.

The inverters were installed inside the memory unit. To take out the memory unit (metallic box near the speaker), it's easier to take off the black plastic cover of the rf unit and local unit.

Take off the cover of the unit on the component side. A 2.5 × 25 mm (.1" × 1") border of the protective paint of the divider unit is scraped off with a small knife. (The divider unit, PB-2084, is the small PC board which is upside down near the top of the box.) Then the inverter board is soldered side to side with the divider unit, as shown in Fig. 8. You can take out the divider unit to pass the cable through one of the top holes of the memory unit's box. Then install the divider unit again in the box and affix the plug to the end of the cable. Solder the four separate cables to the 5101 chips, as shown in Fig. 8.

Now close the memory unit again and install it inside the transceiver.

Testing

Connect the two cables together (the one coming from the diode matrix and the one going to the inverters). Don't worry about the polarity. Either way you plug it in, it will work.

Turn on the transceiver, set it on 20 meters, and set the memory switch to channel 1. Try to save and recall a frequency (say 14.1111 MHz). Now switch to 15 meters and store, *in the same memory channel*, another frequency (say 21.2222 MHz). Going back to 20 meters and recalling memory 1, it should still read 14.1111 MHz.

Now try some other com-

Number	Binary Code	Number of Diodes
0	0000	0
1	0001	1
2	0010	1
3	0011	2
4	0100	1
5	0101	2
6	0110	2
7	0111	3
8	1000	1
9	1001	2
10	1010	2
11	1011	3
12	1100	2
13	1101	3
14	1110	3
15	1111	4

Table 1.

	Cable				5101 Pin			
Bandswitch	A	B	C	D	4	5	6	7
JJY	0	1	1	1	1	0	0	0
AUX2	0	1	1	0	1	0	0	1
AUX1	0	1	0	0	1	0	1	1
10D	1	0	0	0	0	1	1	1
10C	0	0	0	1	1	1	1	0
10B	0	0	1	0	1	1	0	1
10A	1	0	1	0	0	1	0	1
15	0	0	0	0	1	1	1	1
20	1	0	0	1	0	1	1	0
40	1	1	0	0	0	0	1	1
80	0	1	0	1	1	0	1	0
160	0	0	1	1	1	1	0	0
	1 = > 7 volts 0 = 0 volts				1 = 5 volts 0 = 0 volts			

Table 2.

Parts List

D1-19	1N4148 (1N914)	Any small switching diode
R1-8	22k, 1/4 Watt	
T1-4	BC547	Any small-signal NPN transistor
P1, S1		4-pin plug and socket

10" of 4-strand flat cable or 40" of single-strand cable
Perfboard (see Figs. for size)

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4.6 X 5.90 X 1.0 inches

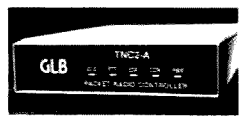
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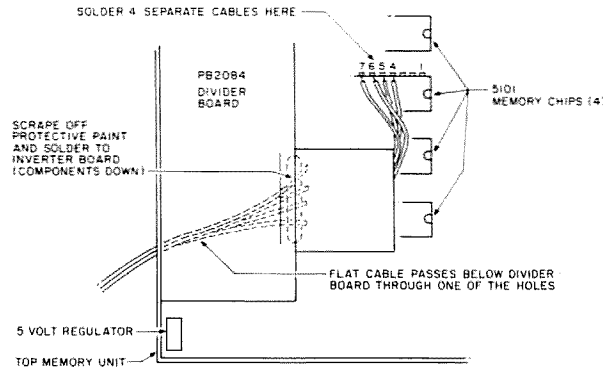


Fig. 8. Inverter board placement.

binations. No combination should alter the contents of any other band or memory number. If you have any problems, they will probably be wiring errors in the diode matrix. Use Table 2 to debug any wiring error or faulty diode.

Finally

Why so many memories? That is probably what Yaesu thought when they left them out in the first place. Now, an owner of an FT-107M can store the emergency frequency for each band on channel 1. He can scan these frequencies using only the bandswitch (the memory switch remains on channel 1).

Then, on channel 2 he can store his favorite nets for each band. You'll have a lot of unused channels, but at only three cents apiece, too many is better than too few! ■



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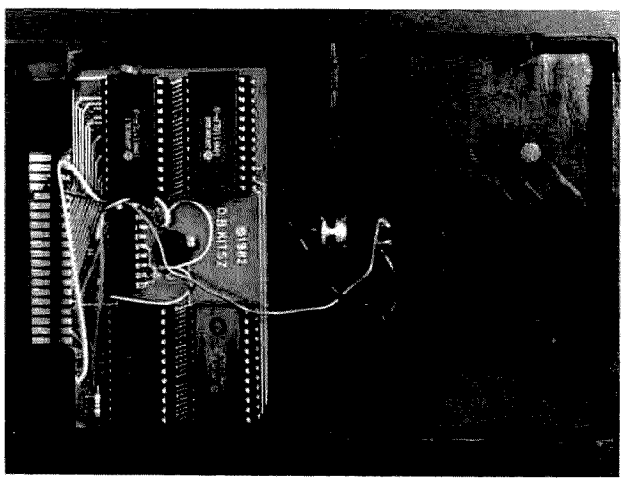


Photo A. A RAM pack configured to give 8K of RAM at the cartridge port. The switch is a "Comprise" auto-execute (see text).

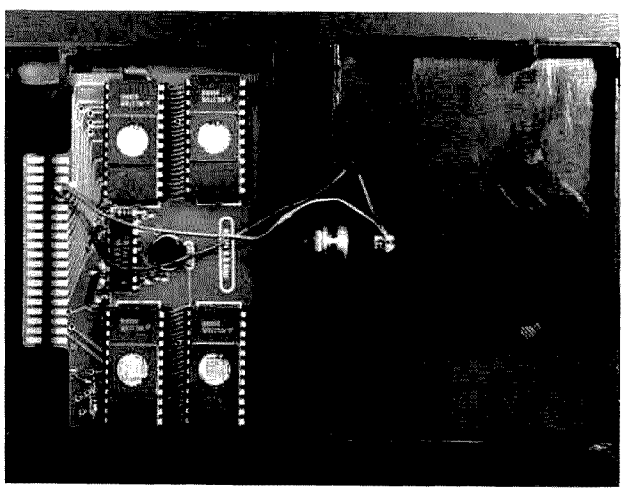


Photo B. A ROM pack configured with 16K of EPROM.

Mailboxes for HF and VHF are becoming more and more popular. As participation increases, there is a growing wealth of information available. In most areas, RTTY pictures, programs, bulletins, and public-domain programs are all available.

There is a tremendous advantage to having the proper software to access these systems. A good program needs

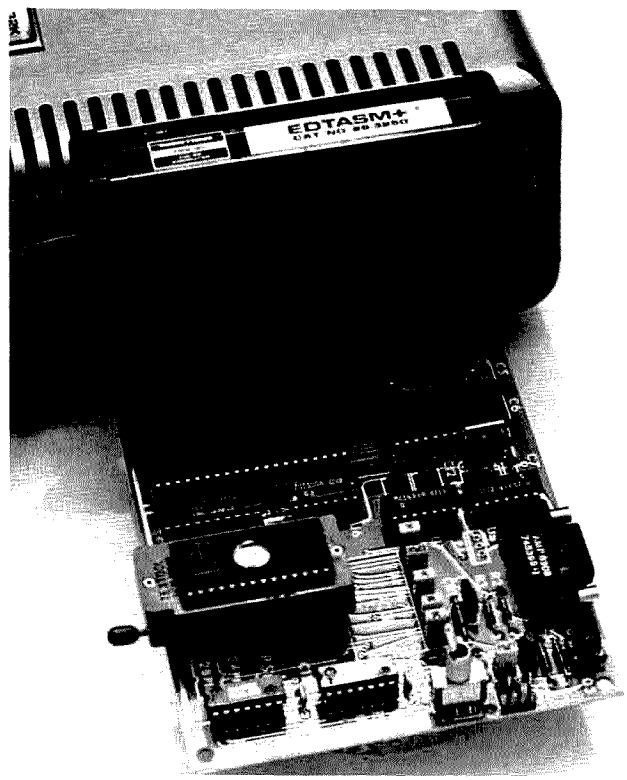


Photo C. The CRA and Associates Universal EPROM Programmer. This unit can be considered a complete development system. It also offers protection to the CoCo via full buffering.

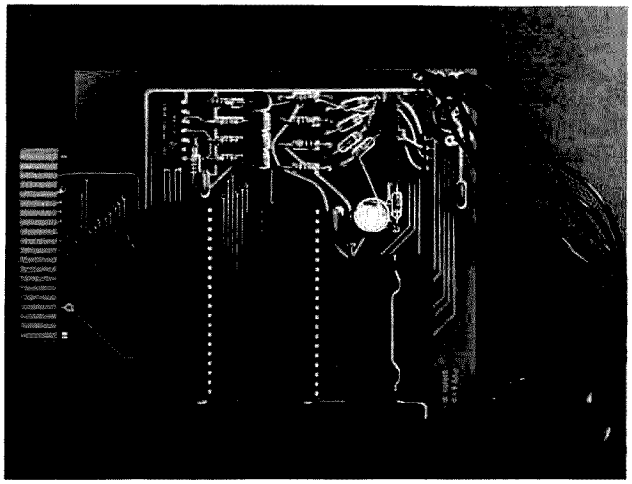
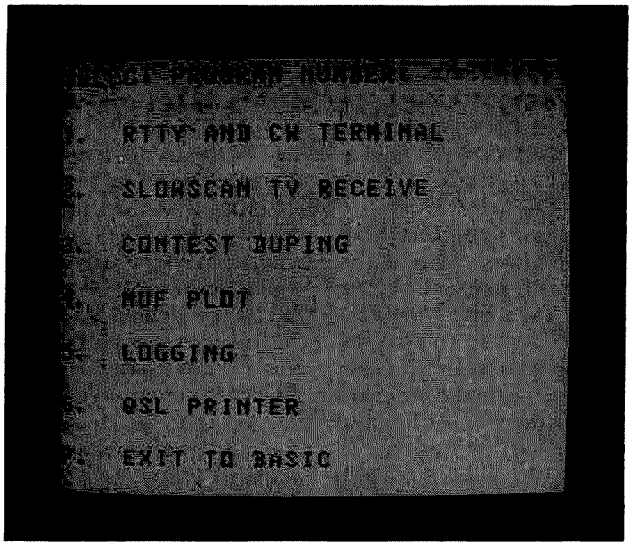


Photo D. The Green Mountain Micro Color Burner—one of the least expensive burners, available in kit form.



A dramatization of what can be programmed. (I wish I possessed a ROMpak with these programs!)

both a transmit and a receive buffer that can be saved and loaded. Using a program which prints only the information you receive can cause you quite a bit of typing should you decide you want to use it again.

The program that I use can be loaded from disk or tape. The program is long—7,341 bytes. A second CoCo is used for my amateur radio operations. I used to hesitate turning that computer off when it was not in use. After each power-down, a long tape load would precede any amateur activity. For this reason, I began searching for a way to keep the program in non-volatile ROM and be able to run it from a ROM pack. Here's how I did it; I call it ROMpak.

The Program

If your program normally runs in memory after a tape or disk load, the chances are that you will not be able to burn it into ROM and run it there. However, you can *store* your program in ROM. If you had a program that would transfer it back to where it should be in RAM and execute it, you would eliminate the tape load.

This is exactly what the loading program does. Once executed, it prints a menu screen with the titles for your programs. You choose the program you want, and the loader puts it into RAM and executes it.

The program as it appears will not do the trick. To make it work you will need to do a little paperwork and figuring. The program itself will require modification.

First, type it as it stands. You will want to assemble it to check for errors. If it is assembled as it sits, EDTASM will give you a wheelbarrow full of BAD MEMORY errors. EDTASM recognizes that you are trying to write to the ROMpak and will tell you that is a no-no. Change line 190 to read:

```
190  ORG  $1000
```

Now try an assembly with the following switches: A/IM/WE/AO. If everything checks, change line 190 back to the original and save the source code.

Your Programs

Although Basic programs can be loaded and run in this manner, this program will work only with machine-language programs. You will need a number of addresses from each of these programs:

1. Where the program begins in RAM.
2. Where it ends.
3. Its length.
4. Where it executes.
5. Where to load it into the ROMpak.

From Basic, CLOADM one of the programs. Do not execute it, but return to Basic. The starting address of this program can be found by typing:

```
PRINT PEEK (&H1E7)
```

and

```
PRINT PEEK (&H1E8)
```

The first value is the most significant byte. Each of these will have to be changed to hex using EDTASM's Z-Bug calculator and concatenated. The ending address is given by:

```
PRINT PEEK (&H7E)
```

and

```
PRINT PEEK (&H7F)
```

The execution address is given by:

```
PRINT PEEK (&H9D)
```

and

```
PRINT PEEK (&H9E)
```

In Z-Bug, calculate the program's length. Enter this information in the worksheet (Fig. 1). Do this for all of the programs you wish to load into the ROMpak.

Modifying the Loader

The loading program requires a number of modifications before we can determine its length. Load the source code and print the menu lines. Modify these with the names you wish to use with each program. You may have more than seven programs to load, in which

ROMpak Formatting Worksheet

Name of Program	Starting RAM Addr.	Ending RAM Addr.	Length of Progr.	Exec Addr.	Starting ROM Addr.	Ending ROM Addr.
	LD#TO		LENGTH#	EXEC#	STPG#	
Loader						
Program #1						
Program #2						

Fig. 1. ROMpak formatting worksheet.

case you will have to expand the menu. If you have fewer than seven and you wish to load more into the ROMs at a later date, the area of ROM where the future menu lines will reside will have to be left blank.

The lines reading FDB $0D0D simply space the menu lines apart on the screen. The program looks for a "$FF" value to end the menu screen. This can either be put in (as in the program) or assumed as unburned ROM.

Once the menu has been modified, type A/AO. As the assembler scrolls the screen, it can be made to pause by pushing both the <shift> and <@> keys. The last byte of the menu, the "$FF" character, is the last byte of the program. By pausing the scrolling when this part of the program is on the screen, the ending address of the loader can be determined. Knowing that the start is at $C000, you now can complete the worksheet. You can also determine this ending address by assembling the source code to the printer (A/LP).

Once the worksheet is complete, enter the values into the source code that the program will need. If you are planning on expansion, remember that you will probably have to make two burn passes. The first will start at $C000 ($0000 relative to the start of the ROM). The second pass will leave the future menu lines unburnt and start loading in the stored program code for the first program.

Building the ROMpak's Code

There are three methods of building the code that will go into the ROMpak. The first is to use the computer's RAM, pretending that some arbitrary byte is actually $C000. Then, using the Z-Bug "P" command, make a copy of the memory.

Since the loader is not memory-independent, you will not be certain that the program will work at its proper address until you have the ROMs burnt. Then it's too late. Double and triple check any code put together this way.

A much more desirable

```
0100 *
0110 * ROMPACK OPERATING SYSTEM
0120 *
0130 * BY STEPHEN W. WOLF
0140 *
0150 * THIS PROGRAM IS PUBLIC DOMAIN
0160 *
0170 *
0180 *
0190         ORG    $C000
0200 *
0210 * LOAD PROGRAM VARIABLES HERE
0220 *
0230 STPG1   SET    $3000     LOCATION OF PROGRAM ONE IN ROMPAK
0240 LD1TO   SET    $4000     LOAD ONE TO RAM FROM HERE
0250 LENTH1  SET    $0100     LENGTH OF PROGRAM ONE
0260 EXEC1   SET    $C000     EXECUTION ADDRESS OF FIRST PROGRAM
0270 *
0280 STPG2   SET    $3000
0290 LD2TO   SET    $4000
0300 LENTH2  SET    $0100
0310 EXEC2   SET    $C000
0320 *
0330 STPG3   SET    $3000
0340 LD3TO   SET    $4000
0350 LENTH3  SET    $0100
0360 EXEC3   SET    $C000
0370 *
0380 STPG4   SET    $3000
0390 LD4TO   SET    $4000
0400 LENTH4  SET    $0100
0410 EXEC4   SET    $C000
0420 *
0430 STPG5   SET    $3000
0440 LD5TO   SET    $4000
0450 LENTH5  SET    $0100
0460 EXEC5   SET    $C000
0470 *
0480 STPG6   SET    $3000
0490 LD6TO   SET    $4000
0500 LENTH6  SET    $0100
0510 EXEC6   SET    $C000
0520 *
0530 * PRINT MENU AND GET PROGRAM NUMBER
0540 *
0550 RETURN  LBSR   $A928     CLEAR THE SCREEN
0560         LDX    #MENU     ADDRESS OF START OF MENU
0570 PRINT   LDA    ,X+       OBTAIN MEMORY
0580         CMPA   #$FF      <$FF> IS DELIMITER
0590         BEQ    GETCHR    DONE
0600         JSR    $A282     ROM PRINT TO SCREEN
0610         BRA    PRINT     NEXT CHARACTER
0620 GETCHR  JSR    $A1C1     CHECK THE KEYBOARD
0630         BEQ    GETCHR    UNTIL A # IS PRESSED
0640         LBSR   $A928     CLEAR THE SCREEN AGAIN
0650 *
0660 * COMPARE + LOAD ONE TO SEVEN
0670 *
0680 BACK0   CMPA   #$31      FIRST PROGRAM?
0690         BNE    TWO       GOTO #2
0700         LDX    #STPG1    START ADDRESS IN ROMPAK
0710         LDY    #LD1TO    ADDRESS TO LOAD IT TO
0720         LDU    #LENTH1#  BYTES IN PROGRAM
0730         LBSR   MOVE      MOVE IT
0740         JMP    EXEC1     EXECUTE #1
0750 *
0760 TWO     CMPA   #$32
0770         BNE    THREE
0780         LDX    #STPG2
0790         LDY    #LD2TO
0800         LDU    #LENTH2
0810         BSR    MOVE
0820         JMP    EXEC2
0830 *
0840 THREE   CMPA   #$33
0850         BNE    FOUR
0860         LDX    #STPG3
0870         LDY    #LD3TO
0880         LDU    #LENTH3
0890         BSR    MOVE
0900         JMP    EXEC3
0910 *
0920 FOUR    CMPA   #$34
0930         BNE    FIVE
0940         LDX    #STPG4
0950         LDY    #LD4TO
0960         LDU    #LENTH4
0970         BSR    MOVE
0980         JMP    EXEC3
0990 *
1000 FIVE    CMPA   #$35
1010         BNE    SIX
1020         LDX    #STPG5
1030         LDY    #LD5TO
1040         LDU    #LENTH5
1050         BSR    MOVE
1060         JMP    EXEC5
1070 *
1080 SIX     CMPA   #$36
1090         BNE    SEVEN
1100         LDX    #STPG6
1110         LDY    #LD6TO
1120         LDU    #LENTH6
1130         BSR    MOVE
1140         JMP    EXEC6
1150 *
1160 * BASIC CALL
1170 *
1180 SEVEN   CMPA   #$37
1190         LBNE   RETURN    ILLEGAL PROGRAM NUMBER
1200         CLR    <$71      CLEAR COLD START FLAG
1210         LDX    #$A027    START OF BASIC
1220         JMP    ,X        JUMP TO BASIC
1230 *
1240 * MOVE SUBROUTINE
1250 *
1260 *   -X:  FROM ADDRESS
1270 *   -Y:  TO ADDRESS
1280 *   -U:  # OF BYTES
1290 *
1300 MOVE    LDA    ,X+       BYTE TO BE MOVED
1310         STA    ,Y+       MOVE IT TO NEW MEMORY
1320         LEAU   -1,U      DECREMENT U
1330         CMPU   #$0000    DONE?
1340         BGE    MOVE      NO
1350         RTS              YES
1360 *
1370 * THE MENU SCREEN INFO FOLLOWS:
1380 *
1390 MENU    FCC    /SELECT PROGRAM NUMBER:/
1400         FDB    $0D0D
1410         FCC    /1.  TITLE OF FIRST PROGRAM/
1420         FDB    $0D0D
1430         FCC    /2.  TITLE OF SECOND PROGRAM/
1440         FDB    $0D0D
1450         FCC    /3.  TITLE OF THIRD PROGRAM/
1460         FDB    $0D0D
1470         FCC    /4.  TITLE OF FOURTH PROGRAM/
1480         FDB    $0D0D
1490         FCC    /5.  TITLE OF FIFTH PROGRAM/
1500         FDB    $0D0D
1510         FCC    /6.  TITLE OF SIXTH PROGRAM/
1520         FDB    $0D0D
1530         FCC    /7.  EXIT TO BASIC/
1540         FCB    $0D
1550         FCB    $FF
1560         END
```

Program listing.

method is to use a RAM pack. This is a ROM pack configured with RAM. Photo A shows a Green Mountain Micro RAM pack configured for the 6116 chip. This gives 8K of memory at the port. 16K can be addressed there and this same RAM pack can be modified to accept four 6116s (piggyback) to have 16K available. (Write to Green Mountain Micro at Bathory Road, Roxbury VT 05669.

If a RAM pack is used, a simple modification to the computer will have to be made. A stock computer cannot write to addresses $C000 to $EFFF. Different RAM packs give different instructions to do the modification. The most simple method to allow the RAM pack's use is to ground pin five of the 74138 multiplexer (U10) through a switch. I have seen other methods that cut pins and use other "no-turning-back mods." Some of these will affect memory map number one in such a way that it cannot be used. That will make full RAM programs, like the VIP Library, useless. Don't cut pins.

The third method entails copying addresses $8000 to $FEFE into the unused 32K of RAM in the 64K chips. This was done by Ray Guavreau in the January, 1984, issue of *Rainbow* magazine (PO Box 209, Prospect KY 40059). You then switch to all RAM and can use the computer's upper RAM to simulate a ROM pack.

My code was assembled in a RAM pack, and this is the way it was done. EDTASM is position-independent and can run anywhere in memory above about $1000. Copy it to RAM by using a U C000 1000 27FF command. It then can be saved to tape with P 1000 27FF 1000. The RAM pack can now be used with EDTASM.

Make an object code tape of your loader. Load this from Z-Bug into the RAM pack. As each of your programs is moved into the loader, you will have to ensure that they do not cream EDTASM. For example, if EDTASM is running at $1000 and you try to load a program in at $1E01, you will load over EDTASM and crash the system. It may be necessary to move EDTASM all over the computer as you proceed.

Load your program into memory using Z-Bug. Move them into the RAM pack with the "U" command. After they are are all loaded, make a tape print of the RAM pack with P RAMPAK C000 (hex address of last byte of last program) C000.

The acid test is to now power down and bring the system back up, reloading the RAM pack. Check each program thoroughly to see that everything is working. If you do find a program which crashes, go back to the worksheet and recalculate all values. Hex numbers are tricky.

ROM Packs

Photo B shows a Green Mountain Micro ROM pack configured with 16K of 2732 EPROM. I have two programs burnt which occupy about 9K. This leaves about 6K for future expansion. (Come on people! Let's see some packet software for the 6809 Color Computer!)

Autostart on a typical ROM pack is achieved by shorting pin seven to pin eight on the connector. The pin assignments go top-bottom-top-bottom so these two pins are above and below one another on the ROM pack. If this is done each time the computer is powered up, it will execute $C000 automatically. Rather than allow it to do that, I have installed a push-button between these two pins. By tapping the button, it effectively does an EXEC &HC000 command. I still can get back into Basic for my day-to-day needs without a power-down and removal of the ROMpak.

PROM Burners

PROM burners used to be $500.00 devices that required an excellent fluency in hex numbers. That has changed.

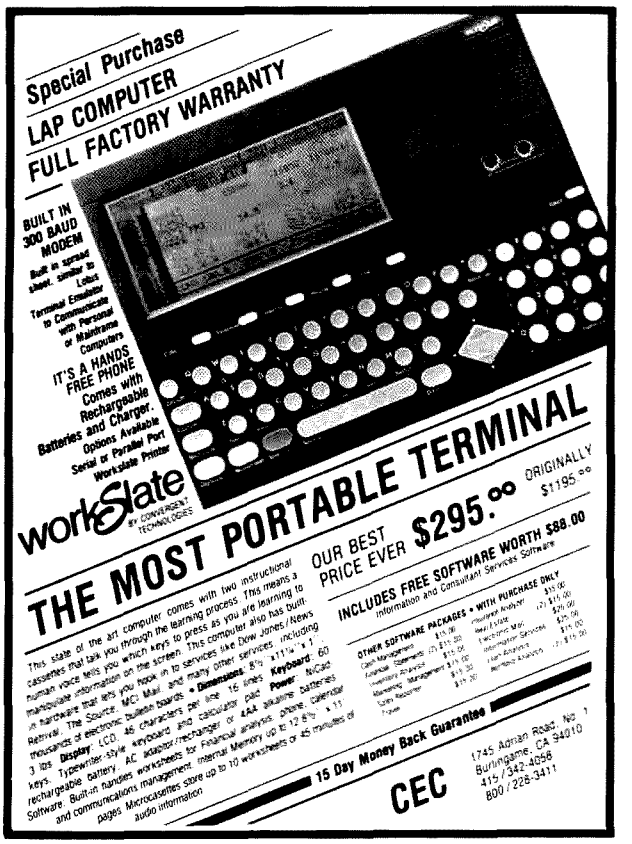
One of the cheapest available burners is available from Green Mountain Micro; it can be purchased in kit form, and except for four transistors is easy to build. These four transistors have extremely close lead spacing and require the utmost care in soldering. The software that can be purchased will allow you to program at least six types of EPROM including a 68764. This last EPROM can be put into one of the sockets used for Basic or Extended Basic.

For a development system, CRA & Associates (31235 Avon Road, Westlake OH 44145) offers a "Universal EPROM Programmer" for the CoCo. A number of bells and whistles are built into this board. First and foremost, a program pack connector is built onto the board. This allows the EDTASM to remain on the board and available. A (true) RS-232 port capable of up to 19.2 KB is also standard. This could be used to burn ROMs for use in other non-6809 systems. Everything on the board is socketed. Protection is obtained through full buffering and current limiting on the program pulse. What else could you ask for?

I cannot detail how the code is burnt into the ROM since each burner is different. All have software available. They show how to take your object tape and put it into ROM.

Conclusion

When I have a few free minutes, I like to pop down to the shack and get into a QSO. The ROMpak has relieved me of the hassle of a tape load to bring up my terminal. Also, I am no longer hesitant to power down after each operation. It is a nice system that could easily be implemented by software designers to put their programs into a ROM pack. ■



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Brazil

Build A Digital IC Trainer

A great helper for testing components, as well as experimentation and circuit development.

Have you made the transition to integrated circuits yet? Perhaps, as in my case, you find that integrated circuits aren't quite as convenient for the experimenter as has been rumored. Let me explain that bit of heresy.

With discrete components, you can throw together a simple circuit quickly by tacking the component leads together as required; with an integrated circuit, the leads are so close together that such an approach invites short circuits and component destruction. The answer to that problem is a trainer designed for digital integrated-circuit experiments.

As I considered the requirements for an IC trainer for myself, I came up with the following as features that should be provided:

- Sockets to accommodate standard ICs with from 8 to 40 pins
- Switches for use in setting up inputs to the experimental circuits
- LED indicators
- Internal pulse generator to provide pulse train for input to experimental circuits
- Internal power supply
- Interconnections in setting up experimental circuits made by jumpers and requiring no soldering

The most convenient socketing arrangement I could find to suit my requirements was a modular

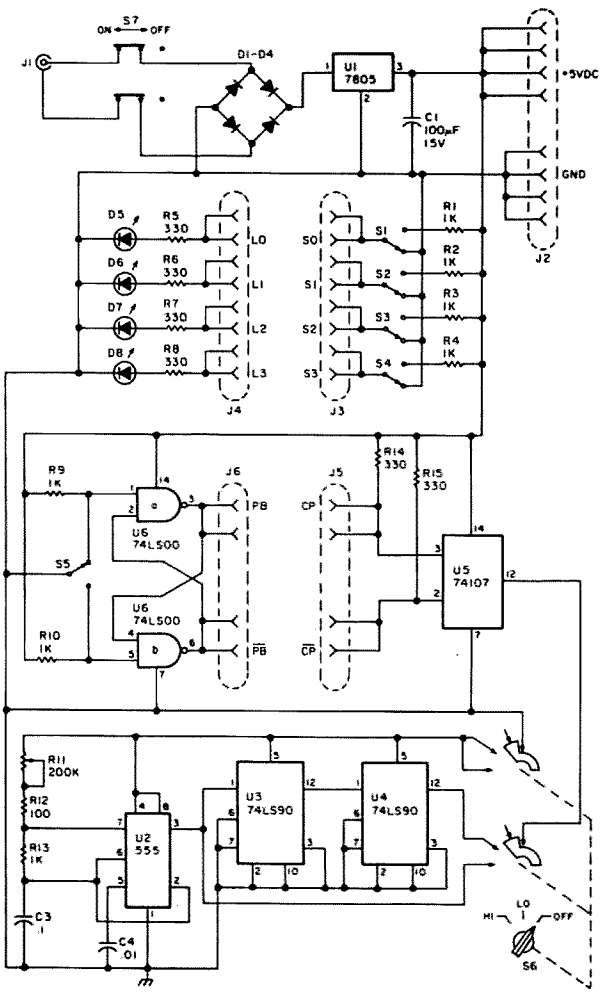
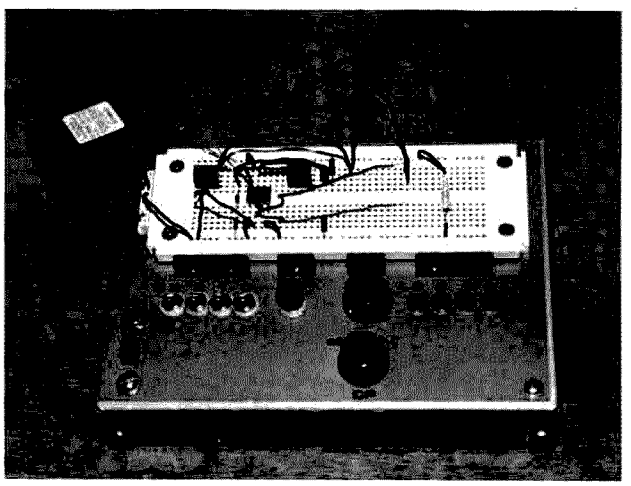


Fig. 1. Digital IC trainer schematic.



The digital IC trainer.

IC breadboard socket such as marketed by Radio Shack. This socket has 550 holes with the same spacing as the pins on common ICs. There are 47 columns of 5 holes which are connected internally in both the upper half and the lower half of the socket. Any of the standard integrated circuits can thus be inserted in the socket astride the center divider and each of its pins will be connected to a column of connection points. Across the top and bottom of the socket are rows of holes connected together horizontally to serve as power-bus connections. Connections can be made to the socket by 22- to 30-gauge solid-wire jumpers.

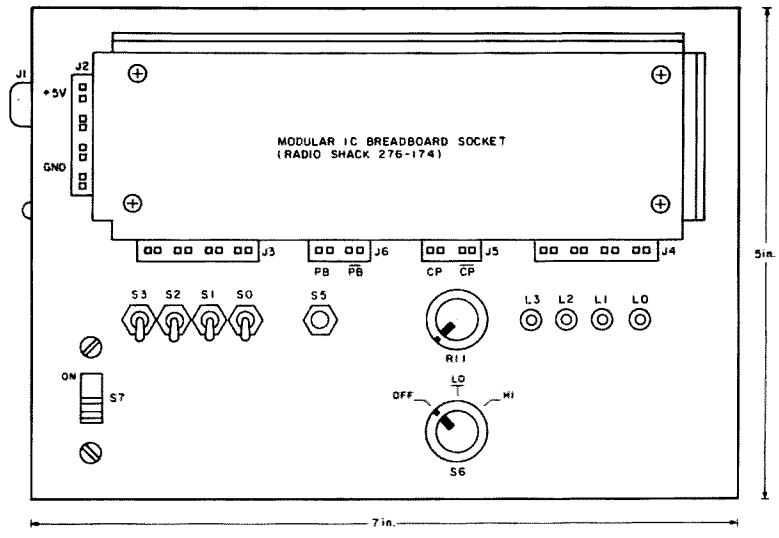


Fig. 2. Panel layout.

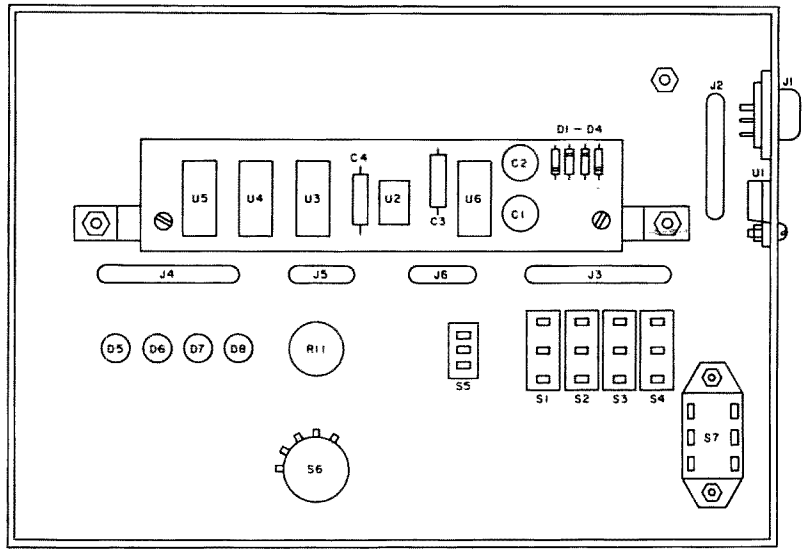


Fig. 3. Interior view showing major components.

Circuit Description

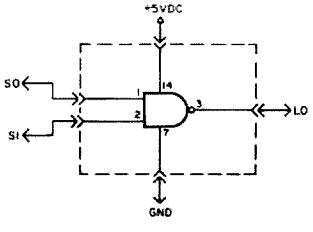
The circuit used is shown in Fig. 1. A power section is provided as well as a switch section, an indicator section, and a pulse-generator section.

The power section has no transformer since there wasn't enough room in the chassis I selected. Instead, the input is connected to a full-wave bridge whose output is regulated by U1 to +5 V dc. The power source connected to J1 can be any voltage from 7 to 35 volts, the limits of the regulator. If the input is ac, the diode bridge serves as a rectifier. If the input is dc, the diode bridge serves as an automatic switch to connect the proper polarity, so it doesn't matter what polarity is connected to J1.

Four SPDT toggle switches, S1–S4, are provided to select between +5 V dc and ground to provide either logic 1 or logic 0 at the jacks labeled S0 to S3. Limiting resistors R1 to R4 prevent catastrophic failures provoked by connecting +5 V dc with 1 Ampere capability to the test sockets. A push-button switch, debounced by the NAND gate circuit, provides a push-button output and its complement at the jacks labeled PB and $\overline{PB}$.

Four red light-emitting diodes are used as logic-level indicators accessible by connection to jacks labeled L0 to L3. Limiting resistors R5 to R8 are insurance against LED failure and are selected to limit current through these indicators to the specified value even when the full dc voltage available is connected to them.

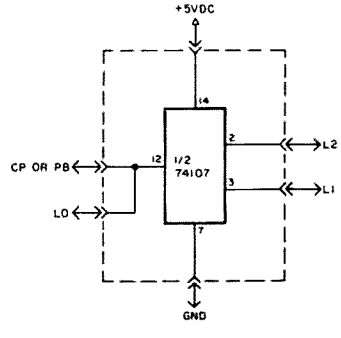
The pulse generator is a



NAND GATE TRUTH TABLE

S1	S0	LO
0	0	1
0	1	1
1	0	1
1	1	0

Fig. 4. 7400 test.

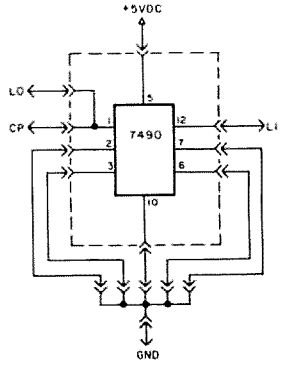


CP	L2	L1
* ↓	1	0
↓	0	1
↓	1	0

* ↓ DENOTES NEG. TRANSITION

Fig. 5. 74107 flip-flop test.

bit more involved. U5, a 74107 flip-flop, is used primarily to provide a clock-pulse output and its complement at jacks CP and $\overline{CP}$. This flip-flop also divides by two, so this must be considered when selecting the frequency of its driving source. Switch S6 selects, as the input for U5, either the output of multivibrator U2 (high range), the output of a divide-by-100 chain (low range), or ground (off). The multivibrator is designed to operate over the range of 500 Hz to 50 kHz, adjustable by R11, so the CP output is 2.5 Hz to 250 Hz in low range and 250 Hz to 25 kHz in high range.



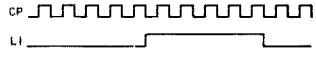


Fig. 6. 7490 test.

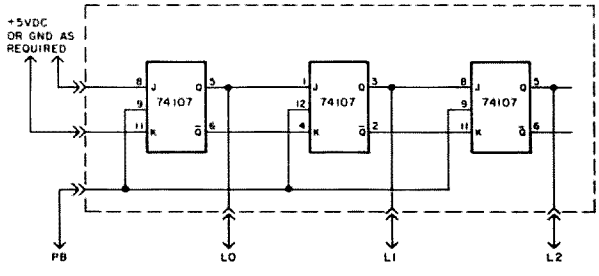


Fig. 7. Shift register development.

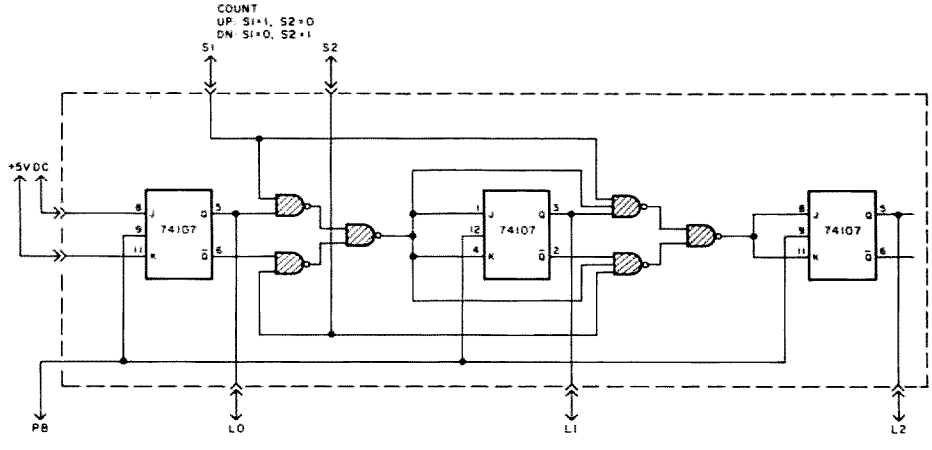


Fig. 8. Parallel up/down counter development.

Construction

The breadboard socket is mounted on the top of a 5″ × 7″ aluminum chassis which occupies about half the available panel space. The remainder of the panel space is devoted to the controls, indicators, and sockets as shown in Fig. 2. The sockets that serve as terminations for the switches, indicators, and power sections are made from IC sockets so that they will be similar to the breadboard socket. Switches and indicators are numbered S0–S3 and L0–L3, respectively, on the panel, conforming to the numbering of lines in a digital bus.

The interior of the digital IC trainer is shown in Fig. 3. The +5-V-dc regulator is attached to the chassis, insulated by mica for heat sinking. As you can see, there is plenty of room for future additions and expansions.

Using the Trainer

The digital IC trainer simplifies testing and experimenting with digital ICs. The IC is inserted into the socket and is powered by appropriate connections to the power buses, which are jumpered to the +5-V-dc and ground connections. Components and jumpers are plugged into the sockets as needed to set up the circuit.

As a simple example, look at the test circuit of the 7400 NAND gate shown in Fig. 4. Pin 14 is jumpered to the +5-V-dc bus, and pin 7 to the ground bus. The inputs, pins 1 and 2, are jumpered to switches S0 and S1 and the output, pin 3, is connected to indicator L0. With power applied, switches S0 and S1 are manipulated to set up the 4 possible input combinations. L0 is read as 1 if on and 0 if off, and the results are compared to the NAND-gate truth table.

A flip-flop can be tested as shown in Fig. 5 by wiring it according to its schematic and clocking its input with PB, using one of the indicators to monitor its output for proper toggle action.

A counter, such as the 7490, can be tested as shown in Fig. 6. Its input can be clocked using CP at a low frequency—or PB can be used so that the division ratio can be determined.

Though useful for testing ICs, the digital IC trainer has been most valuable to me in experimentation and circuit development. For example, I was asked to design a three-flip-flop shift register capable of serial data entry, complement operation, up-count, and down-count. While some, no doubt, find it possible to design entirely on paper and then to build a working circuit, I much prefer to take a project such as this in smaller steps. The digital IC trainer is ideally suited for developing a circuit in steps and provides a means for testing each step before proceeding.

A serial shift register is made by connecting J-K flip-flops so that the inputs to the first flip-flop can be manipulated to clock in a 1 or a 0 and the state to which each succeeding flip-flop will clock is determined by the state of the previous flip-flop. Such a shift register is shown in Fig. 7. The jumpers shown indicate connections from appropriate holes in the breadboard socket to the trainer sockets indicated. Power connections are not shown but are made in the same manner, using jumpers. To enter a 1, the push-button is used to clock the circuit with the J input connected to +5 V dc and the K input connected to ground. For a 0, these connections are reversed. (The operation of the shift register is verified using the trainer before proceeding to the next step.)

The shift register can be modified to form a parallel up/down counter if the first flip-flop is wired to toggle each time it is clocked and the following flip-flops are made to toggle dependent on the Q or $\overline{Q}$ outputs of the preceding flip-flops. If the Q outputs are used, the count will be in ascending binary

Parts List

C1	Capacitor, electrolytic, 100 μF/35 V	$ .80
C3	Capacitor, .1 μF, 10%	.60
D1–D4	Diodes, 1N4001	.25
D5–D8	LEDs, T-1 size	.40
J1	Coaxial power jack	.40
J2–J6	Misc. jacks made from IC sockets	.50
R1–R4	Resistors, 1k, ¼W, 5%	.10
R5–R8	Resistors, 330 Ohm, ¼W, 5%	.10
R9, 10	Resistors, 1k, ¼ W, 5%	.10
R11	Potentiometer, 200k, ¼ W	1.25
R12	Resistor, 100 Ohm, ¼ W, 5%	.10
R13	Resistor, 1k, ¼ W, 5%	.10
R14, R15	Resistors, 330 Ohm, ¼ W, 5%	.10
S1–S4	Miniature SPDT toggle switches	1.75
S5	Miniature SPDT push-button switch	2.25
S6	Rotary Switch, 2-pole, 3-position	1.25
S7	Slide switch, DPDT	.50
U1	7805 Voltage regulator, +5 V, 1 Amp	1.60
U2	555 timer	1.00
U3, U4	Decade counter 7490	.65
U5	74107 dual J-K flip-flop	1.00
U6	7400 Quad NAND gate	.35
	Aluminum chassis, 5"×7"×1⅜"	5.00
	4 Rubber feet	.20
	Modular IC breadboard socket	11.95

Approximate unit prices as of January, 1984.

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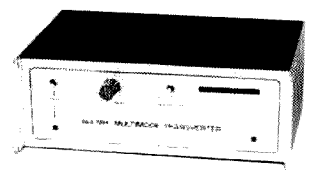
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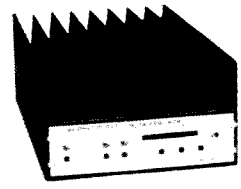
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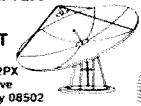
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sequence. If the Q outputs are used, the count will be in descending binary sequence.

This modification consists of wiring the J and K inputs of the first flip-flop to +5 V dc and installing the six gates shown shaded in Fig. 8. When S1 is at logic 1 and S2 at 0, the upper gates are enabled and the Q outputs are selected for up-count. When S1 is at 0 and S2 at 1, the lower gates are enabled and the $\overline{Q}$ outputs are selected for down-count. As in the case of the shift register, the operation of this circuit is verified before proceeding.

The main difference between the shift register and the counter is the source of the J and K inputs of each flip-flop. These two circuits can be combined if provision is made for selecting the proper signals as the J and K inputs for each operation. Similarly, the complement operation can easily be included at this step as it requires only that both inputs of all flip-flops be held high while the circuit is clocked. This switching can be accomplished by the addition of the 12 gates shown shaded in Fig. 9. As before, S1 and S2 control the count sequence. S0 selects shift register operation with a logic 1 or counter with a 0. A 0 on S3 overrides all other functions, forcing all flip-flop inputs high for the complement operation.

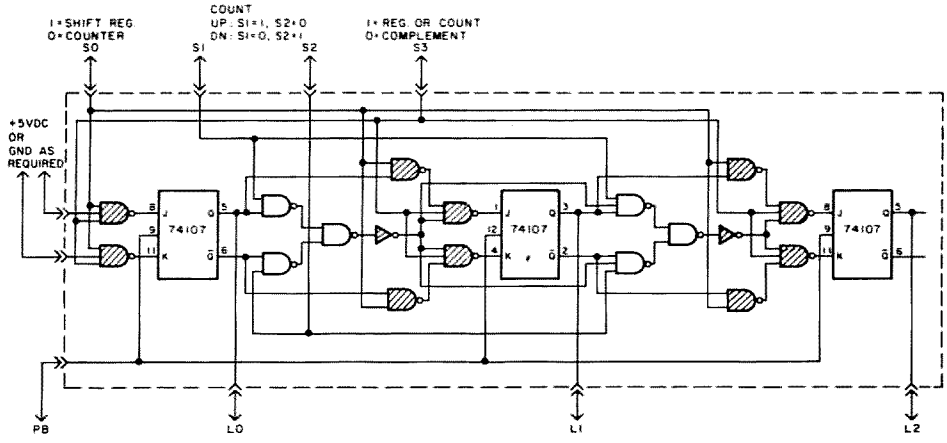


Fig. 9. Shift register and counter combined.

Though the circuit illustrated here has limited practical application, it serves to illustrate that the digital IC trainer is a convenient aid in the development of complex circuits. As the breadboard socket becomes crowded by the inclusion of more circuits, the space available can be extended simply by attaching another socket. These sockets provide for such expansion by means of interlocking grooves. The only limitation is the capacity of the power supply...and the size to which you want to build the working area.

I have found the digital IC trainer to be a valuable addition to my shop. It has proven to be a great help in testing components as well as in experimentation and circuit development. Why not build one for yourself and see if it doesn't make your digital experimentation less painful?■

"When You Buy, Say 73"

Get Organized Today With Argo's Helper

If your present QRP station is comprised of a half-dozen black boxes interconnected with several cables, then this may be the construction project for you.

F. T. Marcellino W3BYM
13806 Parkland Drive
Rockville MD 20853

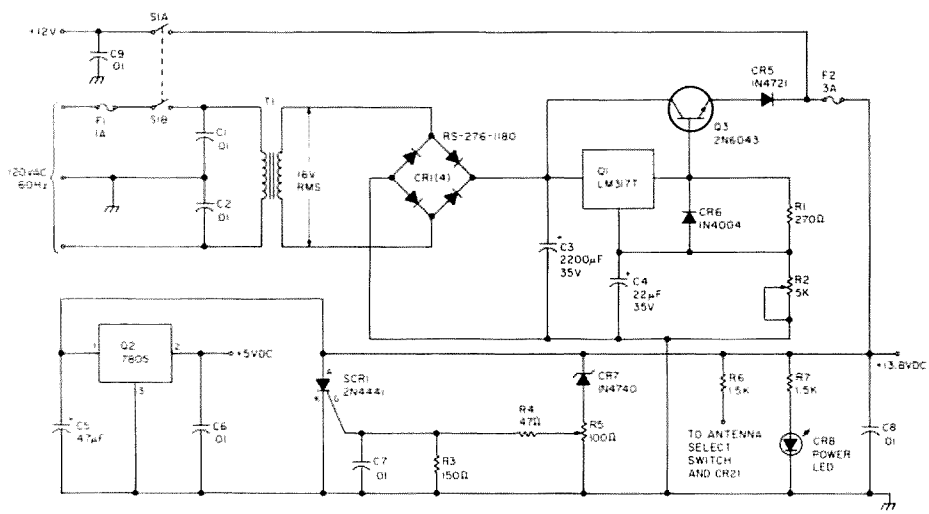


Fig. 1. Power supply and crowbar protection circuit.

Attention QRPers! How would you like an organized station? Would you prefer your favorite accessories packaged in one cabinet? Would you consider increasing the talk power of your SSB signal and having additional features for more operating enjoyment? If you answered yes to just one of these questions, you will

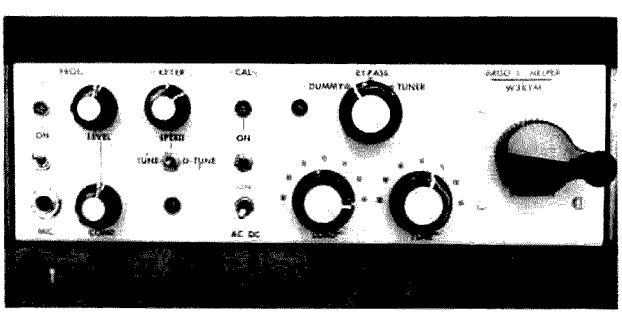


Photo A. Front-panel view—notice arrows indicating direction for tune and delay tune. LED colors are red for power and CAL, green for dummy load and processor.

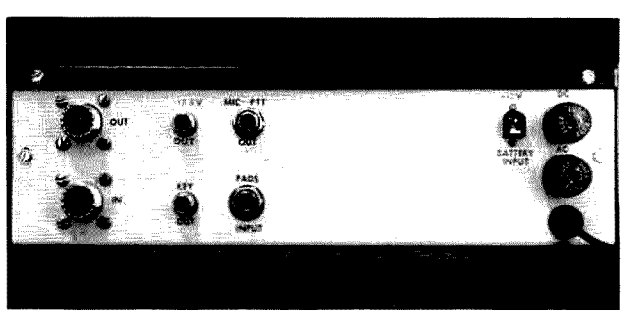


Photo B. Rear-panel view—rf connectors are SO-239, plus 13.8 and key-out are RCA phono types. Plus 12-V-dc battery input is a panel-mount coaxial power connector.

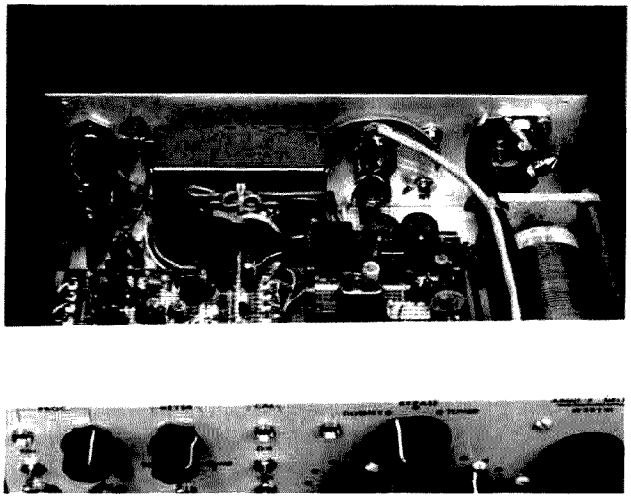


Photo C. Internal rear portion showing major power-supply components. Notice bypass capacitors and RFC1 choke placement.

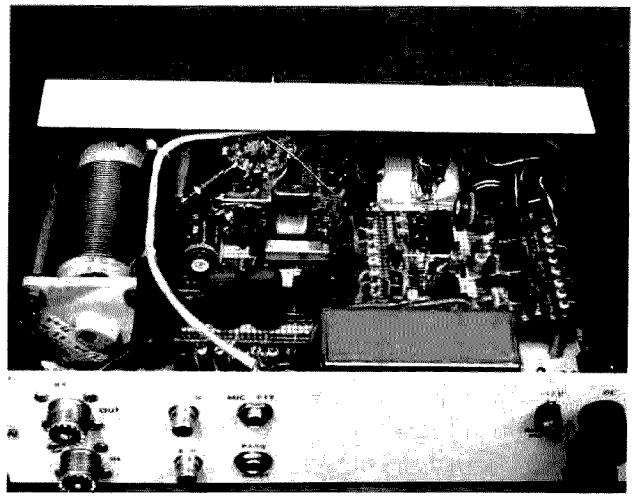


Photo D. Internal front portion showing board layouts and rotary inductor. Notice the RG-58/U routing.

find this article interesting reading. If you answered yes to more than one question, you should consider building a similar project.

This article describes a QRP station accessory that I built to complement my Argonaut 515 transceiver. For those who keep abreast of construction articles in this magazine, you might remember my first station organizer, the "Supernova," that was published in August, 1981.

Since that time I've enjoyed QRP operation a great deal and decided to expand my capability to include SSB operation. I traded my HW-8 for the Argonaut 515 and at that time began the design of the second organizer, which I named "Argo's Helper." Some of the original ideas and circuits are included, but Argo's Helper has several new ideas to provide increased pleasure.

This project features a 100-kHz crystal calibrator, a switchable dummy load with LED indicator, a speech processor with adjustable gain and compression, a delay-tune and full-tune function, an ac power supply with over-voltage crowbar protection and provision for operation from a dc power source, and finally, an antenna tuner using a continuously-variable rotary inductor.

The entire station organizer is neatly packaged into a Ten-Tec cabinet (model LW-10) measuring 10½" × 7" × 3¼". The front-panel switches, knobs, and LED assemblies were purchased from Radio Shack, except for the offset knob for the inductor, which I picked up at a flea market. A turns-counting dial was purposely omitted because of limited front-panel space and the need for only a few turns for most coupling situations.

The internal construction is shown in the photos. For ease of construction, two PC boards (RS 276-162) were used, incorporating point-to-point wire and solder construction. The power supply and crystal-oscillator circuitry are mounted on the center board, while the speech processor and keyer circuits occupy the remaining board.

The series-regulator output transistor is mounted near the back and below the power-supply board, directly on the chassis. The chassis provides an excellent heat sink when the transistor is mounted using a mica washer and thermal grease. The dc output from the regulator is controlled by a board-mounted trimpot, R1, which I preset to 13.8 V dc. The over-voltage crowbar circuit mounted on the power-supply board is preset to about 15.5 V dc using another board-mounted trimpot, R5.

Construction of the tuner isn't critical but requires special attention for mounting the variable capacitors, C38 and C39. These two capacitors must be isolated electrically from the front panel on both their rotors and stators. I accomplished this by using nylon screws with fiber washers threaded into the pre-tapped holes in the capacitor frames. Clearance between the capacitor frames and the bottom surface of the chassis was extremely tight in this installation, requiring a small piece of plastic sheet for complete isolation.

Most of the tuner wiring is on the switch wafer and the two capacitors. The rotary switch is another flea-market purchase which I chose

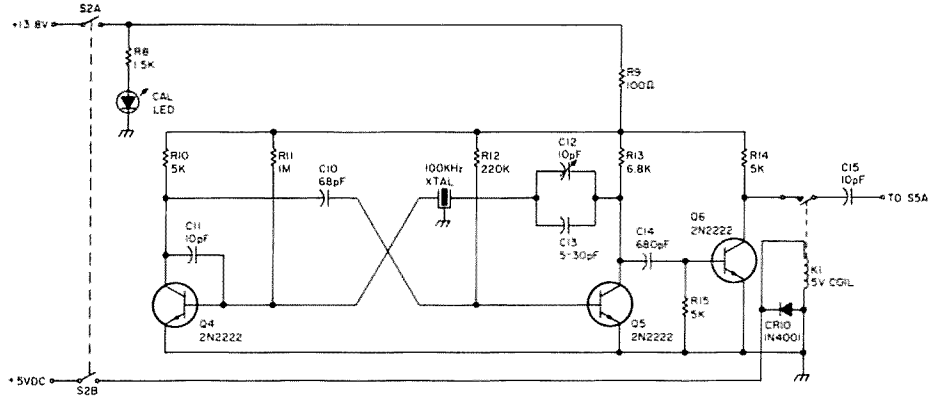


Fig. 2. Crystal calibrator circuit.

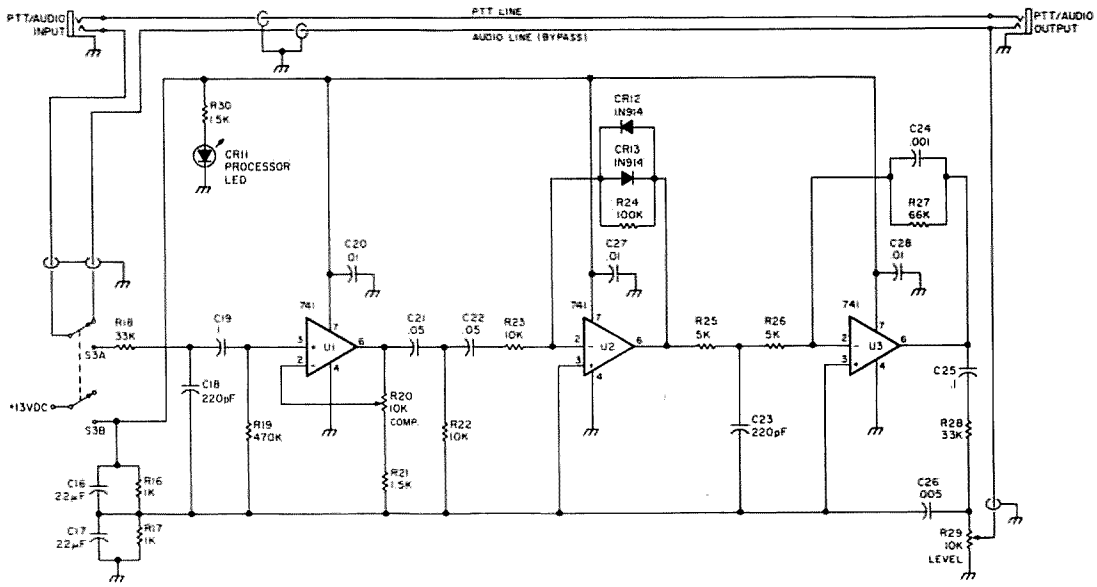


Fig. 3. Speech processor and bypass circuit.

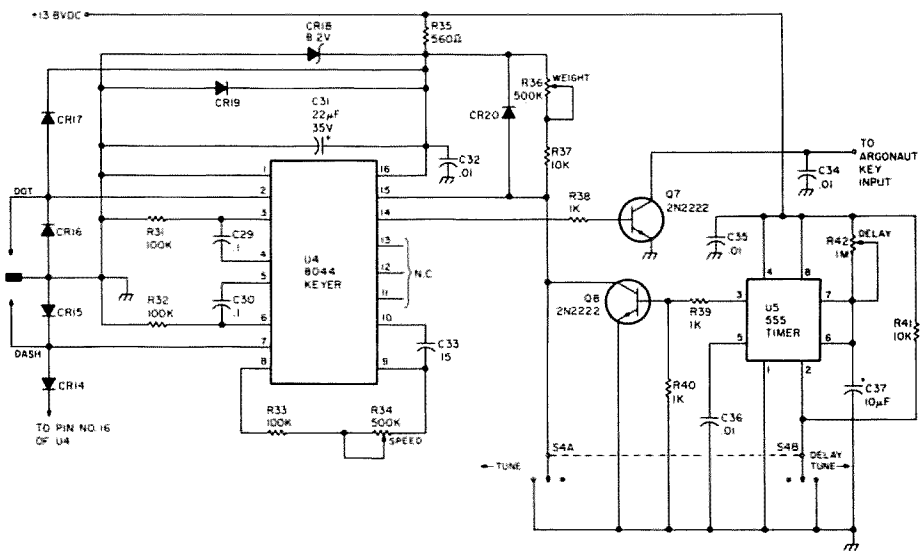


Fig. 4. Keyer and delay-tune circuit.

because it is a miniature, low-loss ceramic type. RG-58/U coax cable was used with the braid grounded from the SO-239 connectors to both wiper arms of switches S5A and B. One bus wire (AWG 14) was used to connect the top of inductor L1 to both capacitors C38 and C39.

The RFC1 choke is mounted directly across the rf-output SO-239 connector. The purpose of this choke would normally be to prevent high voltage from reaching the antenna in the event of a capacitor failure in the final amplifier. In my application, I am using the choke as a dc return path for the dummy-load indicator, LED CR21. When front-panel switch S5A connects the 50-Ohm dummy load to the transceiver, S5B will return the cathode of CR21 to ground via RFC1.

The power-supply circuit is very conventional (Fig. 1). The power transformer has no brand name, but is rated for 16 V rms at 4 Amps. This unit was purchased for $4.00 at a local hamfest, but other transformers (e.g., 18 V rms at 2 Amps secondary) will do equally as well. Power switches S1A and B control either ac or dc input power and diode CR5 protects the regulator circuits when using a dc power source.

The over-voltage-protection circuit will prevent the 13.8-V-dc line from rising above 15.5 V dc if the LM317T regulator fails. If a failure occurs, the gate voltage of SCR1 will reach the trip point set by trimpot R5. This action forces SCR1 into conduction and switches the 13.8-V-dc line to near ground potential very quickly while simultaneously exceeding the limits of fuse F2. F2 will open circuit, thereby protecting the Argonaut and its "Helper" from harmful voltages.

The front-panel power LED and dummy-load LED have their current-limiting resistors, R6 and R7, mounted on the power-supply board. Notice the abundant use of .01-uF disc bypass capacitors. These are very cost-effective devices used throughout the station organizer to bypass any unwanted rf currents to ground.

Fig. 2 shows the 100-kHz crystal calibrator. This circuit uses a standard multivibrator circuit built with discrete parts. Care should be taken to follow the circuit very closely. The 10-pF capacitor, C11, is necessary to guarantee oscillator starting each time the power is applied via S2A and B. The two capacitors, C12 and C13, can be replaced with one larger variable capacitor if one is available. In my circuit, I soldered the case of the crystal to ground using a

short piece of bus wire for added stability. The calibrator will provide an S7 to S9 signal from 100 kHz to 30 MHz, and to ensure this high output, capacitor C14 must be connected to the collector of Q5. The circuit will work if C14 is connected to Q4's collector, but the output is greatly attenuated at high frequencies. Relay K1 was included to protect the output buffer transistor Q6 from rf overload when the Argonaut is transmitting.

Fig. 3 shows the speech processor. This circuit uses a single supply with on-board filtered voltage division. The following brief description tells how the circuit works. The first stage is a common audio amplifier with its gain controlled by potentiometer R20. The second op amp is a audio amplifier with diodes in the feedback loop. If U1's output remains below ±0.6 V dc, it will behave like an amplifier. When audio peaks exceed 0.6 V dc, CR12 and CR13 will conduct and limit the gain of U2. This action keeps the audio level constant on U2's output. U3 is a bandpass filter that removes unwanted harmonics and R29 controls output level.

I built my processor using three 741 op amps in 8-pin packages. The reason for the three-chip design instead of one quad is the ease of component layout. You can use the single quad, but placement of the many components around it presents quite a challenge.

Fig. 4 shows the conventional Curtis Keyer circuit which I used in the first organizer, and because of its trouble-free operation, I decided to use it in this project. The output keying circuit is slightly different, consisting of R38, C34, and Q7. The Argonaut key input presents about a 2-V-dc positive signal to ground. This signal, and hence the keying function, is easily controlled by driving the NPN transistor from the 8044 output pin.

I've added a new feature for holding the key line down for a preset interval; I call it "delay tune." This has been very useful during tune-up periods, allowing both hands to be free to adjust the tuner's inductor and capacitors. Using trimpot R42, I've set the delay tune for 6 seconds, which seems to be a good time interval for this function. The 1-M trimpot will allow about a 10-second maximum delay. Switch S4B (spring-loaded side) will initiate the timing cycle of U5. I also included the conventional full-tune function, which holds the key line down all the time with S4A (standard toggle side). This switch, a DPDT, spring-loaded, one side only, is another special item not readily available, which I found at a flea market for $2.00.

Parts List

C1, 2, 6, 7, 8, 9, 20, 27, 28, 32, 34, 35, 36	.01 uF, 50 V
C3	2200 uF, 35 V
C4, 16, 17, 31	22 uF, 35 V
C5	47 uF, 35 V
C10	68 pF, 50 V
C11, 12, 15	10 pF, 50 V
C13	5-30-pF trimmer
C14	680 pF, 50 V
C18, 23	220 pF, 50 V
C19, 25, 29, 30	.1 uF, 50 V
C21, 22	.05 uF, 50 V
C24	.001 uF, 50 V
C26	.005 uF, 50 V
C33	.15 uF, 50 V
C37	10 uF, 50 V
C38, 39	400 pF, variable
CR1, 2, 3, 4	RS 276-1180
CR6, 10	1N4004
CR5	1N4720
CR7	1N4740
CR8, 9, 11, 21	LEDs
CR12, 13, 14, 15, 16, 17, 19, 20	1N914
CR18	8.2-V zener
F1	3 AG, 1 A
F2	3 AG, 3 A
K1	SPDT, 5-V relay
L1	33-uH inductor
Q1	LM317T
Q2	7850 5-V regulator
Q3	2N6043
Q4, 5, 6, 7, 8	2N2222
R1	270 Ohms
R3	150 Ohms
R2	5k trimpot
R4	47 Ohms
R6, 7, 8, 21, 30	1.5k Ohms
R10, 14, 15, 25, 26	5.1k Ohms
R5	100-Ohm trimpot
R9	100 Ohms
R11	1 M
R12	220k Ohms
R13	6.8k Ohms
R16, 17, 38, 39, 40	1k Ohms
R18, 28	33k Ohms
R19	470k Ohms
R20, 22, 23, 29, 37, 41	10k Ohms
R24, 31, 32, 33	100k Ohms
R27	66k Ohms
R35	560k Ohms
R34, 36	500k pot
R42	1-M trimmer
R43	100 Ohms, 2 Watts
RFC1	2.5-uH choke
S1, 2, 3	DPDT toggle
S4	DPDT spring load
S5	DP3T ceramic rotary
SCR1	2N4441
T1	16 V, 4 A
U1, 2, 3	741 op amp
U4	8044 keyer
U5	555 timer
X1	100-kHz crystal

Fig. 5 shows the antenna tuner with switchable dummy load and indicator. The load was fabricated using two 100-Ohm, 2-Watt carbon resistors connected in parallel. The tuner circuit is a basic T-match circuit and allows me to use practically any antenna. I've included a tuner bypass feature which effectively removes the tuner when a resonate antenna is available for the operating frequency. The two variable capacitors, C38 and C39, are single gang types, having about 400 pF each. Note the connections from the crystal-calibrator output and from the 1.5k-Ohm R6 for the indicator LED.

Calibration and setup of the various trimpots and capacitors is not difficult, but requires a little patience. Adjustment of the main dc voltage is done by monitoring the voltage between the cathode of isolation diode CR5 and chassis ground. Trimpot R2 will set this voltage to any desired value between 12 and 15 V dc. I set my power supply to 13.8 V dc to be in compliance with Ten-Tec's specifications.

The over-voltage crowbar circuit will clamp the main dc voltage to ground in the event of an LM317T failure. Fuse F2 should be temporarily replaced with a 100-Ohm, 2-Watt resistor for this adjustment. Starting with the arm of R5 adjusted to the ground side, slowly rotate the trimpot until the main dc voltage drops to zero. When the trip point is located, rotate the trimpot back toward the ground side about two turns to reach a trip level of 15.5 V dc. In my

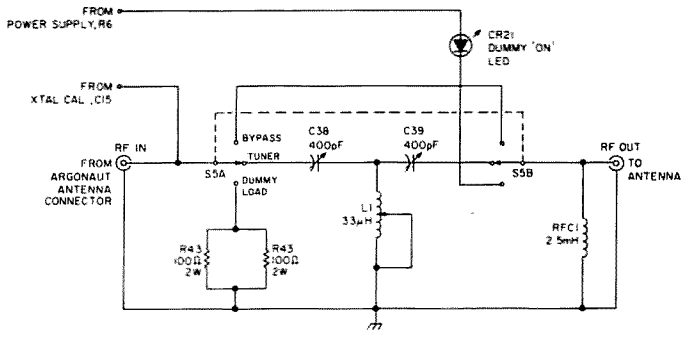


Fig. 5. Antenna tuner, bypass, and dummy-load circuit.

installation, a 10-turn trimpot offered increased settability.

The crystal calibrator was calibrated using my R-1000 receiver, but a frequency counter would be a better standard if available. Set the receiver to a multiple of 100 kHz near 30 MHz and couple the output of C15 directly to the receiver's input. At this frequency and with the same component values, capacitor C13 will vary the output a total of 6 kHz. Zero-beating WWV at 10 MHz is another good method using a suitable receiver. Obviously, the higher the test frequency used, the greater the accuracy of the calibration.

The keying-circuit adjustments are mostly self explanatory. Speed control R34 can be set easily for any wpm between 8 and 50. I set R36, the weight control, for 50/50 operation with a midscale setting. Other weight settings can be determined by monitoring the transmitted signal with an independent receiver.

Operation of Argo's Helper combined with the Argonaut 515, whether in my shack or using a dc power source in the wilderness, has been very enjoyable. The unit is more versatile than the first organizer and could be modified for operation with other QRP rigs. The delay-tune function is used almost exclusively and really helps by freeing my other hand for tuner adjustments. The speech processor gives the 5-Watt signal additional punch and makes a good conversation topic when switched in and out without informing the other operator. The tuner allows better matching on all bands while using a wider variety of antennas.

I hope some of you QRPers will find my ideas useful, or better yet, are motivated to construct a similar unit. If your present QRP station is comprised of a half-dozen black boxes interconnected wth several cables, then this may be the project for you. I will be glad to answer any questions if additional clarification is needed or a circuit problem is encountered. ■

References

1. 8044 Keyer Data Sheet, Curtis Electro Devices, Inc., revised Februrary 23, 1979.
2. "The Supernova Station Organizer," *73*, August, 1981.

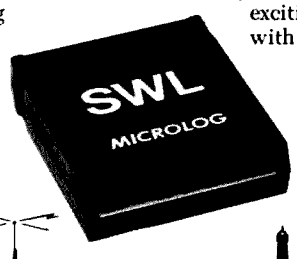
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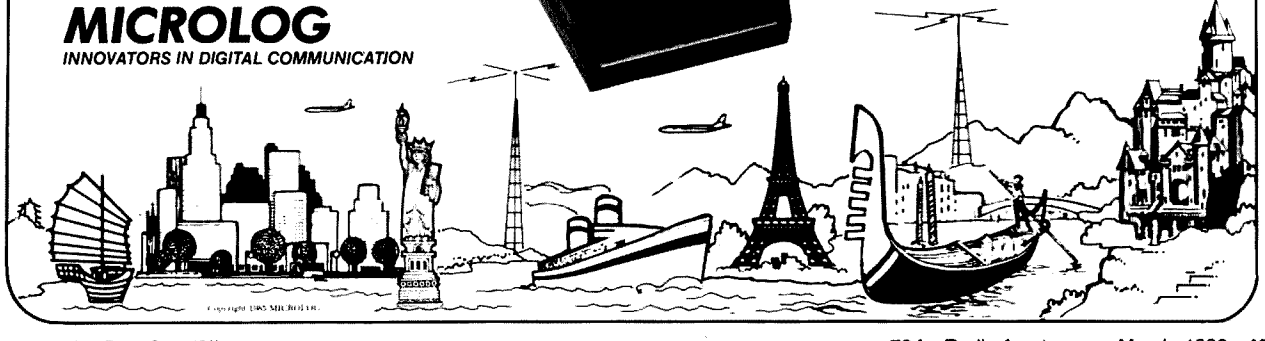
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Recently I bought an antenna system consisting of the usual four units — tower, antenna, rotor, and rotor control. All the gear is nationally-advertised, widely-used, and highly-regarded by hams throughout the country.

But *every unit* came with printed instructions which had serious errors, omissions, confusions, even contradictions. Indeed, at least one error was an absolute farce.

How serious is the problem of ham gear supplied with instructions which are inaccurate, inadequate, inferior, incomplete, or just plan bungled? Apparently no one knows. At least, a diligent search of ham magazines, handbooks, guides, instructions, and other such publications found no helpful reports, tips, or solutions.



Step 19. Solder C14 as shown in PCB schematic using minimum heat setting on page D-11 of the Owner's Manual 349X not reversing polarity carefully. When done check to be sure D5 was installed first.

Casual on-the-air comments by hams in Washington, Ohio, Florida, Nebraska, California, and other states, however, confirm that poor instructions are indeed a widespread concern.

Ham talk also seems to document that most of us select our gear without giving much thought — perhaps no thought at all — to the effectiveness of the printed instructions which come with our purchases. Yet it is obvious that good instructions can make assembling and operating a unit easy, fast, efficient, and safe — a pleasure to own.

On the other hand, poor instructions can cause delays, waste efforts, spark frustrations, increase costs, produce errors, ruin equipment, and create dangers. In extreme cases, injuries can result.

From my unpleasant struggles with poorly-written instructions have come 10 key questions which can help all hams select their gear more intelligently. Along with these questions are specific examples of poor instructions which accompanied ham gear sold in the past year. By now, however, at least some of these problems — it is hoped — may have been corrected. Therefore, the names of the offending companies are not mentioned.

1. *Can you read the instructions before you buy the gear?*

At any of the current 64 Heathkit® stores throughout the nation you can read the instruction manuals for any of the company's more than 50 pieces of ham equipment, no obligation to buy and no cost, of course. And as the manager of the Cupertino, California, store told me, "Take all the time you need."

Or you can buy a copy of any of Heath's instruction manuals. The cost (a few dollars) is but a modest investment to help you be sure the instructions are effective and that you'll be able to follow them.

On the other hand, when I phoned cross-country to ask a manufacturer of antenna towers for a copy of the instructions for putting up one of its towers which I was considering for purchase, the chief engineer told me, "We don't lend or sell copies of our instructions. You'll get them when the tower's delivered." By then, you are of course pretty much trapped into using the instructions,

bad as they may be; it's clearly not practical to return a tower which can cost several hundred dollars for shipping alone.

2. *Do the instructions make sense?*

Some ham gear comes with instructions that are clearly impractical, unrealistic, even downright foolish. An overstatement? Consider this example.

This farce was included in the 15-page *Instructions for Installation and Operation* for a nationally advertised antenna tower. The purchaser was instructed to lay a concrete foundation on which to raise the tower—a foundation 24 inches square and ten inches deep. That would be a block weighing some 500 pounds.

A few pages later those same instructions told the purchaser that *after* the 480-pound tower was in place on top of that 500-pound foundation: *If tower is out of plumb, shift the concrete foundation block to bring it into vertical alignment, and then backfill firmly around the foundation.*

Can you imagine the struggle to try to prop up one corner of that 25-foot-high, 980-pound mass, or lowering another corner, to get the entire installation sticking straight up in the air?

3. *Are the instructions free of contradictions?*

Instructions which came with one "world famous" beam antenna warned, "Correct assembly and dimensional adjustments are very important to successful operation." Later in those same instructions, the length of one part of an element was stated to be 51 inches; in a table which followed, the length for that same part was given as 50 inches.

Worse still, when I phoned the manufacturer to ask which dimension was correct, I was told, "Ohhh yes...we know about that error. But we haven't got around to correcting our instructions as yet."

Contradicting instructions also came with that infamous tower we've been using as a fine source of poor instructions. On one page the purchaser was told to place "the base hinge plate [which attaches the tower to the concrete foundation] hinge side away from the wall as shown on Detail FB." That "detail," a drawing on the next page of the instructions, showed the hinge reversed, its side *toward* the wall.

Later, those same instructions introduced two contradictions with one sentence. It said the "pulley and safety rest have been inverted so that its [sic] arm will not project outward" during shipping, and therefore "must be reversed as explained below." The instructions "below" never mentioned reversing the pulley; however, that made sense because the pulley arrived not reversed, as stated, but welded firmly in position. And the safety rest, which the instructions said to "reinstall," arrived not installed in reverse, as claimed, but came uninstalled, in parts, unassembled.

4. *Are the instructions free of unnecessary jargon?*

The problem in trying to establish guides for this criterion is that language that is jargon to one person may be perfectly understandable to someone else. Furthermore, the more you read and use jargon, the quicker it may become understandable and therefore acceptable.

The first time I read the *Owner's Manual* for my new rotor control, I was confused by such jargon as "Rec Last," "SCAN then 7," "Counter Clockwise end travel," "access memory location #1," and many other expressions. But at this moment, after rereading the manual many times during the several months I've been using the control, I'm having difficulty finding examples of jargon in the manual; I've finally learned the language.

So try to avoid instructions which are jargon-packed, but also remember that those strange-sounding sentences will probably become clear to you as you reread the instructions and work with the equipment.

5. *Are the instructions specific?*

The instructions for the winch which came with my antenna tower included this great line: *If brake disc mechanism operates intermittently or erratically, brake disc inspection should be accomplished.*

Ignoring that twisted syntax, I searched without success for instructions on how that inspection should be "accomplished." Should I dismantle the winch? Should I look for loose parts, dangling cable, or whatever? *Well,* I thought, *forget the inspection—how do I fix the winch when it operates "intermittently or erratically"?*

No instructions on that, either.

Other nonspecific instructions you should watch out for include such lines as: "Adjust as may be needed." —"Place in a suitable location."—"Tighten as required."

6. *Are the instructions clear?*

The 30-page booklet which came with a nationally-advertised rotor control unit includes instructions not only for the model I bought but for two similar but more sophisticated models.

If the instructions for those other models had been in separate sections of the booklet, there would be no confusion. But this instructional booklet intermixes directions for operating all three units. Often there is little or no indication that the instructions do not apply to my particular equipment. When I first read those instructions, I would suddenly find myself trying to learn how to operate features that were not on my model. Confusing, indeed.

7. *Are the instructions in a logical sequence?*

I haven't found any manufacturer's instructions which say something such as, "But before doing that last step, you must. . ." But some instructions come pretty close to such confusion.

Page 11 of instructions for assembling a beam antenna said to install screws, lockwashers, and nuts on some straps. The instructions didn't state on which side the screws should be placed, yet in later steps the placement of that hardware became critical.

A very serious injury was almost caused by what was left out of another instruction. It said to "mount the balun clip to the circular boss." It did not include a warning that during the mounting the clip might become loose and fly off at a high speed. It did fly off, hit me in the forehead, broke the skin, and caused bleeding; if it had hit me just one inch lower, I would probably now be blind in one eye.

On the other hand, if you want to read instructions which are a model of logical sequencing—indeed, a model of the ideal instructions on almost every criterion—look at a Heathkit manual. Each of the more than 25 Heath manuals I've used starts with an "Introduction," a brief overview of the purpose, use, and features of the unit. Next are tips for "Unpacking," to make sure you do not mix parts intended for one board, for example, with those to be used on some other board. Heath manuals also present "Assembly Notes," hints on tools, identifying parts, soldering, and such.

Then come detailed step-by-step assembly instructions presented in a very logical, clear-cut sequence. There's a check-off system

Judging Instructions for Ham Gear
Check-Off List

When evaluating the instructions which accompany ham gear you are thinking about buying, check off each item below to help you decide if the instructions are effective.

_____ 1. Can you read the instructions before you buy the gear?
_____ 2. Do the instructions make sense?
_____ 3. Are the instructions free of contradictions?
_____ 4. Are the instructions free of unnecessary jargon?
_____ 5. Are the instructions specific?
_____ 6. Are the instructions clear?
_____ 7. Are the instructions in a logical sequence?
_____ 8. Are the instructions free of any "surprise instructions" which may come after you've ordered the gear?
_____ 9. Do the instructions include a phone number you can call for help—ideally an 800 (toll-free) number?
_____ 10. Are you confident the instructions tell you everything you need to know?

to help ensure that you install each part correctly. There are numerous drawings, enlarged drawings of small units or more difficult steps, and photos. Many parts are identified four ways: by Heath part number, circuit component number, electronic values, and by a description of markings.

Final sections of Heathkit manuals present operating guides, procedures "In Case of Difficulty," specifications, circuit description, schematic, and other details. Unlike some other instructions, you'll rarely need to search back and forth through Heathkit manuals for an out-of-sequence step.

8. *Are the instructions free of any "surprise instructions" which may come after you've ordered the gear?*

"Surprise instructions" are such unrevealed details as additional equipment that may be needed, restrictions on use, limitations on locations, unexpected safety recommendations, unmentioned delivery problems, and such.

About a week after I'd ordered that infamous tower—but *before* the tower was delivered—I received in the mail three additional instructions from the manufacturer—details I'd not been told about before ordering the tower.

One instruction was printed in brilliant red on bright yellow paper. Across the top of the page, in letters a half-inch high, was the word "WARNING!" Then came these statements (among others):

- Be sure to check your shipment carefully before acceptance.
- All shipments are made at the risk of the purchaser and (name of the tower) will not be responsible for shortage, loss, or damage occurring in transit.

As fate would have it, the antenna was delivered during a heavy rainstorm. But even without the rain, you can imagine the problem of trying to get a big and busy truck driver to wait as you unpack, count, and inspect some two dozen parts ranging from 20-foot tower sections to 1¼" cotter pins.

A second page of surprise instructions came only after the tower was ordered. It was titled "Duty of consignees to accept freight even though damaged." It presented four long paragraphs of quasi-legal statements claiming that if what I'd ordered was delivered in a damaged condition, I had to accept it no matter what! The final point in those instructions: If the gear arrives damaged, "it is decidedly to [your] advantage to either repair [it] and file claim for cost," or "to sell the merchandise 'as is'" and then "file claim for the loss suffered."

Sure enough, the gear arrived damaged. I phoned the manufacturer and firmly pointed out that while such a provision might be enforceable in the state from which the tower was sent, it probably could not be enforced under the laws of the state in which it was delivered. The manufacturer backed down immediately and sent replacement parts.

Another example of surprise instructions came with a beam antenna. It was not until page 16 of the instructions—just as the antenna was about ready to be raised—that I was told I'd need a 3- or 4-foot mast ("not supplied") to use in finding the "balance point" of the antenna.

While many hams have hefty stocks of such supplies stored at their QTH, I don't. The result can be an unexpected dash to the hardware store, inconveniently and unfairly delaying friends who have gathered to help raise the antenna. A minor point? Perhaps. But why shouldn't all instructions present—right at the start—a list of everything you'll need to complete the project?

9. *Do the instructions include a phone number—ideally an 800 (toll-free) number—you can call for help?*

include this detail. Heathkit instructions always include phone numbers for technical assistance, ordering replacement parts, and such, although they are not toll-free. If the instructions you're evaluating don't give a phone number, there are three steps to getting information you need.

First, of course, phone the store from which you bought the unit. If the staff there can't give you the information you need, then phone the corporate headquarters of the manufacturer of the gear. Ask for "customer service" or "the expert" on the gear which has the problem instructions.

If you still don't get the answers you need, don't hesitate to phone the president of the company. It's been my experience that a surprising number of top executives are readily available and will have the information you need sent to you quickly. Indeed, I find that the president's personal secretary (but often no one less) also will get you answers promptly.

The doubter asks, "What about the extra cost for the phone calls?" Even several cross-country calls cost but a tiny percent of the expenditure you are considering investing in the gear. Besides, you may be lucky: When you call, the key person may not be in, so you can leave a message asking him or her to return the call to you; then the cost is on the company's bill. Presidents, in particular, I notice, generally return calls promptly.

10. *Are you confident the instructions tell you everything you need to know?*

This question is obviously difficult to answer—perhaps impossible—until you are actually trying to follow a set of instructions. Still, there are a few precautions you can take.

First, you can try to find some other ham who has used the gear and ask him or her how complete the instructions are. You might have used another set of instructions, for some other gear, put out by the same manufacturer. Check these; the chances are that if a company has prepared clear-cut, specific, valuable instructions for one of its units, then instructions for

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"About two [illegible]ught an Isotron 80 and just recently got it out of th[illegible]p on a 18-foot pole. I am really intrigued by it an[illegible] of fun trying to convince other statioos that it is o[illegible]igh. I worked California whan it was hanging by a [illegible]the ceiling of the shack and it works even better [illegible]NE8DF" (Photo: Isotron 160)

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its other gear are likely to be effective, too.

Another possibility: Compare the instructions with those prepared by another company.

As a last resort, you might ask a salesperson or a manufacturer's representative if the instructions include all the information you'll need. It's not likely they'll tell you about any shortcomings, but if they say, "Yes, the instructions are complete," and you find later that they are not, you may have a bit more clout in trying to get the additional information you need.

In sum, as you consider the purchase of any piece of ham gear, you should be able to answer "yes" to all, or substantially all, of the above questions to help ensure that the instructions for the equipment are effective. If you must answer "no" to more than a few of those questions, you might well shop around for some other unit which may have better instructions.

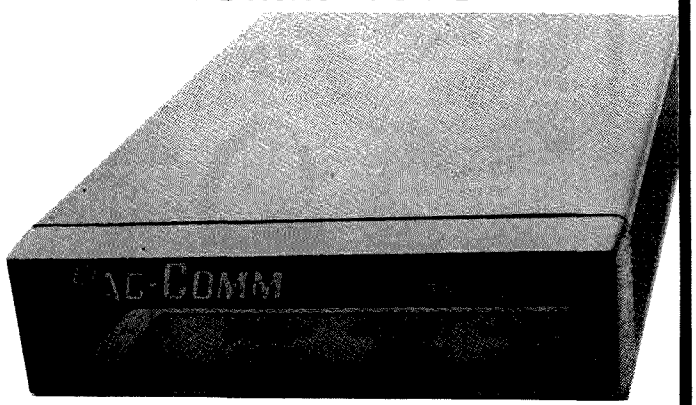
Realistically, many of us don't want to reject buying a unit just because the instructions are poor. So if you find good gear with poor instructions, you should certainly contact the manufacturer to try to get clarifications.

Still, one key problem remains: Many instructional guides seem clear-cut and easy-to-follow when you're considering the purchase, but later, when you're assembling, installing, or operating the gear, you may face doubts, questions, and confusion.

Unfortunately, shortcomings in instructions for ham gear will very likely continue until hams themselves unite to tell manufacturers that their instructional manuals must follow specific criteria. Until then, we'll have to continue to depend on the ancient Latin proverb, *Caveat emptor*—Let the buyer beware. ■

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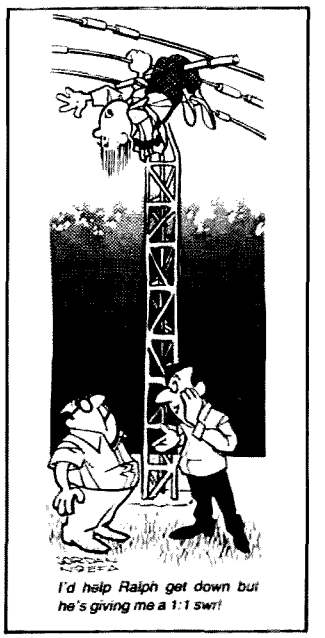
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I'd help Ralph get down but he's giving me a 1:1 swr!

REVIEW

KANSAS CITY KEYER

Dayton. Lance Johnson had a booth there, on a corner I think it was, and he was hawking a keyer, pretentiously claiming that with it, "CW would never be the same again." I can remember seeing a group of ogle-eyed contest types huddled around the display, listening to the code coming out of a tan box, their fingers twitching and their smiles broadening as Lance led them through his spiel.

The next time I thought of Lance Johnson's Kansas City Keyer was a few hours after a grueling ARRL Sweepstakes. It was grueling because I had spent twenty-four hours flailing away at my ten-year-old Accu Keyer; by hour six, each dit and dah required a supreme effort of will! It was in that quiet, ringing-head time after the contest that I remembered those twitching fingers and broad smiles and swore to myself that, come next test, I, too, would have a reason to smile—my Keyer arrived a week later.

Outside

The Kansas City Keyer comes in an attractive two-tone tan box which is about four and a half inches wide and seven inches deep. There are two LEDs, a green one for power and a red one marked "Status," which monitors the machine's reaction to what you are trying to do. To the right of the LEDs is a rotary pot that serves both as an on-off switch and an analog speed control. The rest of the front panel is taken up by a sixteen-button touchpad (0–9, A–D, *, and #) which you use to access the Keyer's functions.

The rear panel is home to two RCA jacks, used for either positive or negative keying voltage, a momentary-contact Reset button, a DIN jack for connecting the Keyer to your paddles, and a miniature phone jack for power (8 to 18 volts dc).

Inside

The true beauty of the KC Keyer is evident when you pop the cover. What you get in there is a powerful microprocessor dedicated to one job—managing your CW. The micro is a Rockwell 6502, a very popular and flexible chip found in many single-board computers (including the successful Apple II). Three chips are used in supporting roles: a 6522 Peripheral Interface Adapter, a 4K EPROM for program storage, and a 6116 2K SRAM for on-line memory. A handful of discrete components and SSI chips completes the hardware. The PC board is plated, double-sided, and obviously laid out by a professional.

Is there any advantage to using a general-purpose microprocessor for this sort of job instead of gates and clocks? Yes! Two advantages, in fact. The first is a reduced parts count—all of the gates and timers found in the last generation's keyers can be implemented in software. Of course, the program to do this may be quite long, but memory is so cheap today that program size can be discounted as long as the coding is efficient.

The second advantage is that a keyer in software can do anything that you want it to! Want automatic serial numbers? Fine, just write a few program lines. Need translation from Morse to International code? No problem, just add a lookup table. You get the idea. An additional plus is that upgrades are as easy as swapping a single EPROM. Power On!

Now we know what the KC Keyer looks like and what's inside it, but what can it do? When the power is turned on, the Keyer will be in its default configuration: speed at about 15 wpm, standard weighting, and automatic character spacing. The fourteen message buffers will be empty and the automatic serial number will be set to zero.

Programming is accomplished via the sixteen-button keypad. Each pushbotton has an assigned function which is assessed by pressing the * key. For example, pressing the sequence * Speed 2 5 will set the speed to 25 wpm. Speed is above the 2 on the keypad. A short beep is output through the internal speaker to confirm each keypress.

One small gripe about the speaker: There is no provision to disable the sidetone from the keypad. The beep is handy to have during the programming steps, but after about ten minutes of CW it becomes annoying. I ended up permanently disabling the sidetone by clipping the wire off the speaker. It would have been better, I think, to have used the rotary pot as a volume control rather than an analog speed control.

The Buffers

What really sets the Kansas City Keyer apart from other memory keyers on the market is the way the message buffers are set up. There are fourteen of them, 0-9 and A-D, and you can partition the 1500-character memory among the buffers any way you like. Text is entered by sending CW to the keyer after specifying which buffer is to hold the information. An "editor" of sorts is available in this mode; if you make a mistake, a string of eight dits will erase the current word and play back the word before it. Perfect word spacing is as simple as watching the red Status LED: At the end of each word, wait for the light to flash before entering the next code group.

Now for the really *good* stuff! You can at any time during text entry add a Wait command. When the command is encountered during transmission, the keyer will stop sending until a character or word is sent manually from the paddle. Say you have buffer A configured like this: TEST DE KW1O (WAIT) TU 5NN NH K. When message is selected, the Keyer will send TEST DE KW1O and stop. Now send the call of the responding station on your paddle: KM1C. After the C, the KC Keyer will continue with the message in buffer A: TU 5NN NH K.

You also can chain buffers together. Let's put TEST DE KW1O (WAIT) (B) in buffer A and TU 5NN NH K (WAIT) (A) in buffer B. Selecting message A will put the Keyer into a loop of calls and answers; if no one responds to your CQ, just select A again.

Automatic serial numbers are available, too. Add a pound sign (#) to your message for this option. I use one buffer for answering the inevitable requests for repeat—it DECrements the serial number and sends the exchange again. The number can be set at any time directly from the keyboard, and pressing the pound sign by itself will cause the Keyer to send the current serial number (be aware that doing this will also increment the number).

Remote Buttons

Any one of the features I've mentioned so far would have convinced me that the KC Keyer was in a class by itself, but Lance Johnson was on a roll! They decided that it would be neat if four of the message buffers were available remotely. What they designed was a little bracket made to attach to a Bencher paddle that brings out buttons A, B, C, and D. (I also tried it out on a set of Nye paddles—it fit without modification.)

This means that you can program buffers A-D with the appropriate information and operate an entire contest by pushing little buttons on your paddles! I do this with my left hand; my right hand is free to log and dupe. There's plenty of time for paperwork as the Keyer is busy sending the exchange.

The Keyer has a provision for battery backup. At first I thought that was odd, but I soon found it indispensable. I happened to have a couple of students who were learning Morse code. It was very easy for me to rattle off ten or fifteen minute's worth of practice into a buffer at 30 wpm at home, then take the Keyer to class and play back the material at 5 wpm. The Rate function let me set the character speed at 13 wpm, a method used by most instructors.

Last Words

Obviously, I like the Kansas City Keyer. I think you will, too. It is expensive—about $200—but what you get is a flexible CW computer that does things you can only dream about with your present machine. The manual is *very* good, and a newsletter comes out now and then which features programming tips and modifications.

If you are *serious* about CW, get in touch with *Lance Johnson Engineering, PO Box 7363, Kansas City MO 64116*.

Perry Donham KW1O
Rindge NH

ISOTRON SOLUTION FOR THE 160-METER BAND

Since the opening of the 160-meter band to amateur use, the 1.8-band-selector position on my FT-102 has been gathering dust. Like a number of hams, I simply do not have space to put up a 252-foot-plus wire antenna for 160 meters. Even if space was available I doubt if I would consider a wire antenna because of the difficulty I had in getting permission to put up my 5-band vertical at my apartment. It would be nice if there was a zero-space antenna for the 160-meter band!

Baltimore, Maryland, is approximately 500 miles from my QTH, and my contact with WB3GBF on 40 meters opened my eyes to the signal power of the Bilal Isotron antenna. My RST using a 5-band

vertical was 5–9 while WB3GBF's RST, using an Isotron 40-meter antenna, was 5–20 dB over 9. And to top this, he was using it inside his apartment.

As an ARRL Assistant Technical coordinator for North Carolina, N4BTK asked me to help him with his 20-meter-antenna problems in a local Senior Citizen retirement apartment complex. John lives on the 12th floor and had been using a coil-loaded window antenna but for some reason, 20 meters, even at the altitude of a 12-story building, was very weak. I suggested an Isotron 20-meter antenna as a better solution since the management would not permit a vertical or beam to be mounted on the roof. John's Isotron 40 was mounted 3 feet from the apartment's windowsill on an offset 1"-mast section. By comparison, it out-performs my 5-band vertical on 20 meters.

Impressed with the two-band performance of the Isotron antennas, I contacted Ralph Bilal WD0EJA about his 160-meter antenna and proposed that I work with it to obtain details for an article. My thought was that perhaps only an Isotron could give me 160-meter operation in my apartment complex, and this was an opportunity for me to see what it could do.

The Isotron antennas come in a kit form that can be fully assembled in less than an hour using only a screwdriver and 7/16" socket wrench (Photo A). They are definitely unique in that no frequency model occupies more than an area of 1.5' x 2' x 2.5', and most frequencies even less. Technically speaking, they defy the accepted antenna theorem of voltage and current distribution on a dipole antenna. One cannot help being impressed when seeing an Isotron in operation.

Assembly begins by attaching a formed aluminum plate to the insulated top support member. In my assembly of the 160-meter antenna, I first installed the mast clamp, U bolts in the end of the insulated bar and attached it to a mast section. This method supports the insulated bar while you attach the formed metal plates.

I followed the same method to mount the square metal lower support section to the mast for attaching the lower formed metal plate. Since the top and bottom plates are aluminum and will quickly oxidize, I spread a thin film of No-Ox over the surfaces that would overlap when bolted to the support bar.

No-Ox is a common non-oxidizing compound used to prevent aluminum oxidization of electrical wiring and is usually available at most electrical supply houses. After attaching the top and bottom formed plates, my antenna looked like bird wings, one above the other (Photo B).

The rather large antenna coil is attached between the top and bottom support bars by adjustable bolts Inserted in the top and bottom sections of the coil. I inserted both bolts and loosely positioned their lock nuts so that final centering of the coil could be accomplished with minimum effort. I attached the top of the coil to the top insulated support bar first and ran the coil's bottom bolt through the bottom support without attaching the securing nut. This was to permit attachment of the two plastic side panels without first adjusting the position of the lower support bar attached to the assembly mast.

At this point of the antenna's assembly, only the 1/4–20 bolts holding the formed metal plates to their respective support bars had been tightened securely.

There are two transparent plastic side panels to be attached to the top and bottom formed plates. One plastic plate contains a terminal. After loosely attaching the top ends of the two side plastic plates to the top plates, loosen the bottom support bar mast clamp and gently raise or lower the bar until the side plate holes line up with the bottom plate's holes. Insert the 1/4–20 bolts. At this point, all 1/4–20 bolts joining metal to metal may be tightened securely.

Those 1/4–20 bolts connecting the side plastic plates to the metal of the top and bottom plates should be tightened with less force than the metal-to-metal bolts to prevent shattering of the plastic. These bolts may be finger-tightened if used in connection with locktite or other thread-locking compounds.

Centering the coil between the top and bottom plates is not difficult. Merely measure the distance between the bottom and top ends of the coil to their respective metal plates—not the support bars. There should be some tension put on the top and bottom formed plates by the coil's bolts that will pull the formed plates in slightly. This increases the rigidity of the plates to eliminate wind flutter and subsequent detuning of the antenna. (See Photo C.)

Pre-soldered wires with closed terminal ends connect the PL-259 antenna cable connector to the coil's top-end winding and the top formed plates. A second closed terminal from the PL-259 connector connects to the coil's bottom-end winding and to the bottom formed plates (see Photo D). The resulting electrical circuit is a simple LC series circuit with the top and bottom plates forming the plates of a capacitor connected in series to the coil.

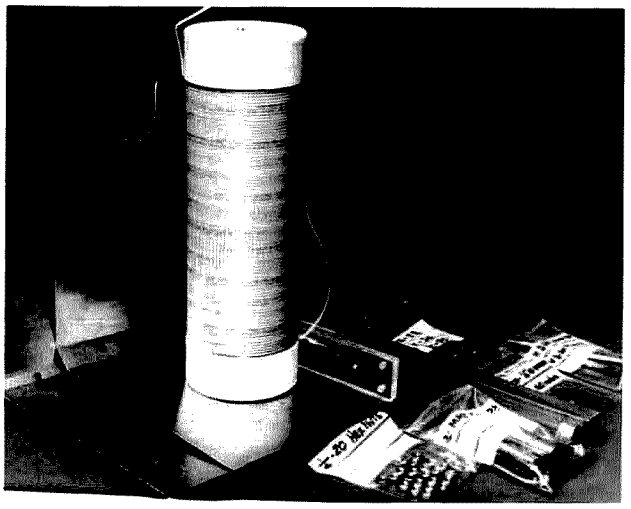


Photo A. The Isotron 160 kit.

The final assembly consists of two threaded L-shaped rods on which two small rectangular aluminum plates are attached (Photo B). It would be advisable to round all edges of these plates with a file, including each corner, before attaching to the bolt. This will reduce rf-energy discharge into the atmosphere.

The actual antenna assembly is basically an easy push-in-a-bolt-attach-a-nut operation. At worst, it takes no more than an hour. The hard part comes in the final tuning of the antenna. This is done by moving the tuning plates on the L-bolts until the lowest swr ratio has been reached.

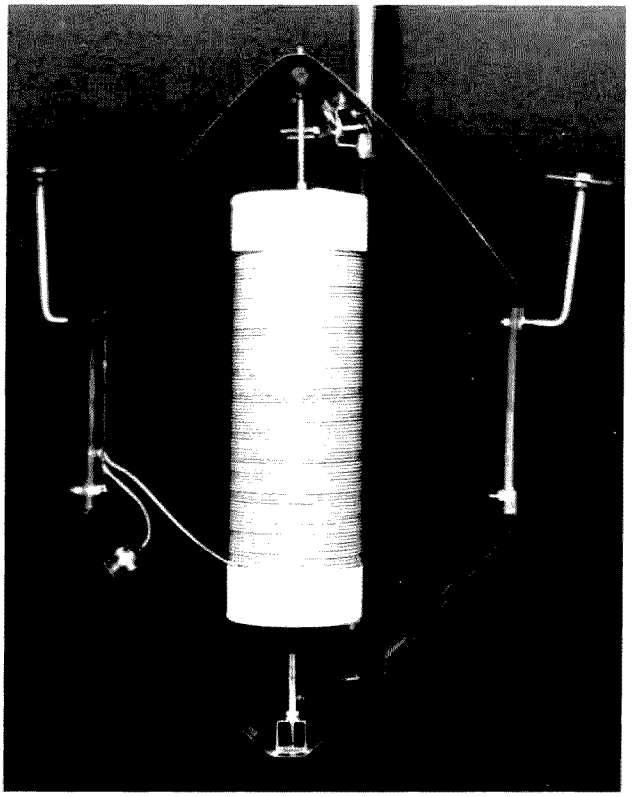


Photo B. The Isotron 160 assembled.

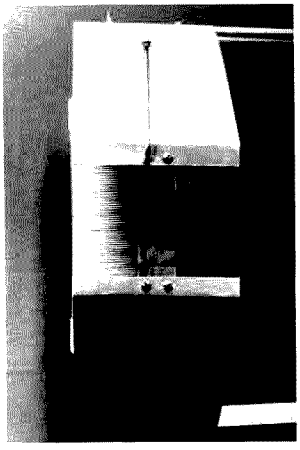


Photo C. Side view. The plastic holds the upper and lower wings together under slight tension.

This will be a trial-and-error approach where you select your transmit frequency, and, at the transmitters lowest power level, tune the finals to resonance and note the swr indication. Now turn off the transmitter and make a very slight change in the positions of both tuning plates. Turn on the transmitter and recheck your swr. This procedure is repeated until the swr lowers to between 1:1.5 and 1:2.0.

The Isotron 160-meter antenna produces such a strong rf field at 100-Watts input that it is unsafe for indoor use. It is best used outdoors at a height above ground where no one walking by could possibly reach it and suffer rf burns or shock.

The advantages of the Isotron antennas are small physical size, no ground-plane radials required, and minimal parts, for trouble-free operation. Its radiation patterns are typical of ground-mounted vertical antennas when it is connected to ground by an 8-foot-copperclad ground rod. The only disadvantages are tuning it and a somewhat narrow bandwidth.

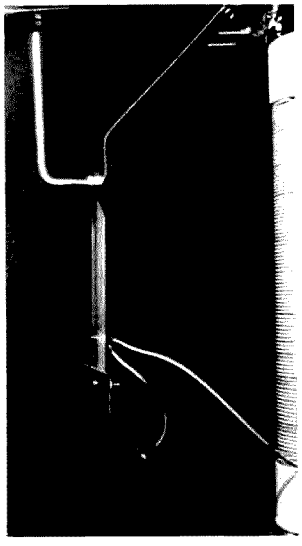


Photo D. One of the tuning plates.

I believe that a remote tuning system, using plastic components and nylon or monofilament control lines, could be added to the tuning L-bolts that would enable the antenna to be remotely tuned under power to eliminate the present difficulties when frequencies outside of the antenna's bandwidth are wanted.

I visualize connecting the two L-bolts together with a small plastic rod which could be moved forward or backward by the movement of the line in the manner that a pointer on a radio-tuning dial is moved by the dial cord. Another approach would be to use two control lines so that each tuning plate's bolt could be moved independently by a dual-cord system.

I do not know if atmospherics or lack of 1.8 MHz activity in my area was the reason I made no 1.8 MHz contacts in the period I had access to the antenna. I do know that it boosted the background noise level from zilch to S-9 on my FT-102.

James A. Grupton, Jr. KF4PW
Charlotte NC

USER'S REPORT

Ralph Bilal gives you a complete set of instructions for tuning his antennas, and the 160-meter version is no exception. I placed the antenna on a seven-foot mast at ground level and began the preliminary tuning procedure using an MFJ antenna-noise bridge and the station receiver. The antenna is designed to be resonant, as received, just above 2.0 MHz, and Ralph recommends that you try it out under low power to check your swr at a frequency just below the top band edge.

The antenna environment at ground level will make a difference in your results because of antenna capacity to ground and to nearby objects. I supported it temporarily with one of those umbrella tables with a hole in the center. This one was aluminum, and I knew that it would affect the antenna resonance point somewhat. Sure enough, it resonated a bit above 2.0 MHz, but I was able to add the small tuning rods provided and achieve resonance at about 1950 kHz.

There are two rods, one mounted on each side of the antenna at the top plate. Bringing them down from the vertical to the horizontal by simply rotating them on their mounting hardware and retightening them, lowered the resonance to below 1900 kHz. I reasoned that this was close enough for now, and that by mounting the antenna on the roof I would be able to lower the resonant frequency still further.

Incidentally, it would be good to point out that *any* antenna which is only a small fraction of a wavelength in size and consists of "lumped" values of inductance and capacitance, will necessarily have a limited-frequency bandwidth, so I did not expect to be able to cover the entire band with one setting. As it turned out, I was able to cover only 25 kHz either side of resonance without retuning the antenna, but that's getting ahead of the story.

So far, things were going according to plan, and the moment of truth had arrived; it was time to install the Isotron 160 on my chimney mount, up in the clear and away from surrounding objects—or at least as far as possible considering that my "antenna farm" is a hole in the midst of trees, with the nearest being about 25 feet away.

Another point: I prefer antennas that are tuned to resonance at the antenna and not in the shack by means of a coupler or antenna tuner. In other words, I like to bring the coax directly to the transceiver and not have to go through any sort of matching device to make it work. This requires that the antenna itself be properly tuned.

It took only a few minutes to mount the antenna to the chimney bracket and secure it for testing. Since I happened to have RG-59/U available (instead of the RG-58/U which I prefer) I used that, and connected it to the chassis-type connector on the antenna. Tuning up the rig was easy, and the antenna accepted power readily at 1900 kHz—but not at 1850 where I wanted to center it. Back up to the roof again to adjust the tuning rods; down the ladder to the check and another tune-up. After about three trips, I got the antenna to resonate at 1860 kHz—close enough for government work, as they say.

And Now, For The Test

It was necessary only to wait until dark now to test the antenna—a time when I knew that there would be stations available for contacts. As it turned out, I could have done my on-the-air tests right away because there was a contest in full swing! Nevertheless, I did wait until about 2130Z, and began to tune the band.

There was plenty of activity. Normally, I prefer CW operation, but in testing this antenna I reasoned that SSB should be a more difficult evaluation mode because the antenna would really have to put out a good signal to compete with the stations using full-size antennas for this top band.

Tuning, tuning. . .oops, here's one: *"CQ Contest, CO contest, from VE1ASJ, VE1ASJ, Contest, K."* Frequency 1823 kHz. Quick, now.

"VEQASJ, VE1ASJ from W1XU, W1XU, New Hampshire. Over"

"W1XU from VE1ASJ; five nine of hive, OSL?

"VE1ASJ from W1XU; OSL and thanks, OM. Five nine oh five. Good luck in the contest." Wow, the antenna worked into the Maritimes!

In quick succession, I worked VE3OME (Ontario) and VE2DVI (Quebec) with 5/9 signal reports. Then, I happened upon K2LXN and KA1W; Connie in Parish, New York, and Dave in Bridgeport, Connecticut, having a nice QSO. Calling KA1W, Dave came back with a *"Five nine plus 10 dB, here in Bridgeport OM. Nice signal; how do you copy W1XU, Connie? K2LXN from KA1W."*

"W1XU, with KA1W, here is K2LXN. Nice signal OM in Parish, New York. Five and nine on a noisy band. How do you read me? Over."

"Thanks lot, gentlemen. This is an experimental antenna, and I really appreciate the reports. You're both doing well here through a lot of QRN, and both well above S9. Good chatting with you, and so long from Peterborough, NH. Name is Jim, and I'll be looking for you on 160 again. Seventy three."

Great stuff, this antenna really seems to get out. Frequency was . . . hmm, let me see . . . 1850 kHz. Not bad at all. A little later I heard W3GFR calling CQ at exactly 1850 kHz. There—he's signing.

"W3GFU, W3GFU, W3GFU, here is W1XU, W1XU, Whiskey One X-Ray Uniform in Peterborough, New Hampshire. Over."

"Roger, Roger. W1XU from W3GFU right back. Thanks for the call. Name here is Jim and the GTH is Churchville, PA near Philadelphia. Your signal is five by nine here, with some QSB. How do you read me? W1XU from W3GFU, over."

W3GFU from W1XU. Hi, Jim, good to hear you. My name is Jim,

too, and you're coming through just great; also five by nine here in Peterborough, New Hampshire. I'm running about 100 Watts to an experimental antenna, and would like to see how it goes for a few minutes."

These exchanges lasted for 45 minutes, and during this time I learned that Jim was transmitting on an inverted vee dipole at 40 feet and had a TS-830S (I was using my TS-820S) at about the same power output. His receiving antenna was a coaxial loop, about five feet on a side and rotatable. Although the received signal strength was down a bit on the loop antenna, Jim reported the signal-to-noise *ratio* was better, and he planned to install an amplifier to improve the signal.

When I described my own antenna, Jim was enthusiastic and wanted to know more. He remarked that it ought to be ideal for an apartment dweller, a condo owner, or someone in a travel trailer—virtually anywhere a full-sized antenna couldn't be used. Naturally (with great satisfaction) I agreed.

During the course of the conversation, Jim said: *"100% copy; really amazing! Really hard to believe that it works that well. You're doing a job—and as good as many of the signals I hear from guys running the same or even more power on big, outside antennas. The guy who designed that antenna must be a pretty smart cookie."*

And so it went. Other contacts have been as rewarding, too. On CW and phone, the Bilal Isotron antenna performs very well, indeed—perhaps much better than I had any right to expect. I've had fun with it, but can't claim that under all conditions it will out-perform a big antenna. That would be ridiculous. However, I can recommend it for the ham who needs to operate 160 meters but can't put up a larger one.

Make no mistake, it is a bit fussy to tune, and you're going to have to be patient and take your time with it. The bandwidth in my case is about 50 kHz either side of resonance between the 2:1 VSWR points. Ralph's antenna, which is at 40 feet and tuned to perfection, gives about 100 kHz between the 2:1 vswr points on either side of resonance.

As a last measure, I went up on the roof and painted all of the critical connections with weatherproofing—because I plan to leave it up this winter and enjoy 160!

By the way, I did hear some DX coming through—faintly, but it was there. No hope, of course, to contact it with the Isotron . . . or is there?

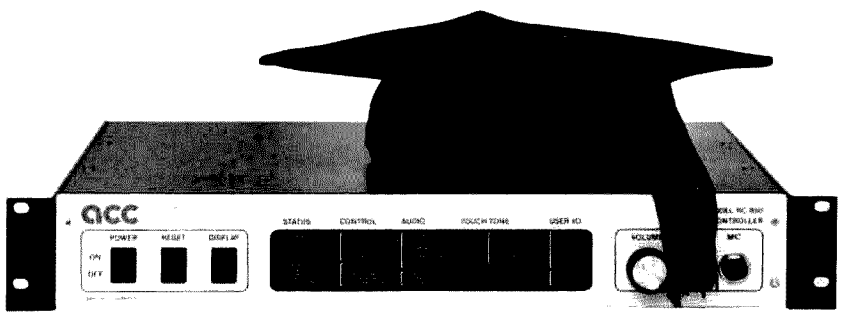
Jim Gray
***73* Staff**

MMT 144/28R TRANSVERTER MICROWAVE MODULES

I love transverters. I've got six of them right now for various assorted purposes on four different bands driven from three different radios. Not surprisingly, five of the six are made by Microwave Modules of Liverpool, England, long the biggest maker of transverters for sale in this country (and perhaps the world as well). MM has long made a quality product allowing transmit and receive conversion of 28-MHz signals to 50, 144, 432, and 1296 MHz, as well as 144 MHz to 50, 432, and 1296 MHz. They even have a model that allows operation on 28 MHz from 144 MHz. Talk about covering all the bases!

Naturally, I was excited to hear about the new line of MM transverters for 1985, which feature GaAsFET front ends and 25 Watts output. In addition, the new models claim input sensitivity as low as 1 mW for rated output. At this time, the only model available in this country is the MMT 144/28R, and I was able to obtain a sample for review from the US importer, the "PX" Shack.

The MMT 144/28R is a handsome unit, as shown in Photo A. This is a big departure from the old black-box approach to transverters—i.e., you set 'em and hide 'em away. With its LED bar-graph power display and attractive faceplate, this unit demands to be set out on your operating desk. MM has retained the rf VOX-type keying of previous models, where your 28-MHz signal actuates the



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transmit section and the drop-out is determined by the front-panel potentiometer.

The rear-panel connections are similar to earlier MMTs. They have retained the 5-pin plug for power and keying. Also included are UHF connectors for 28-MHz transmit and receive signals, as well as a single UHF connector for 144-MHz antenna. This latter departs from previous designs as there is no provision for a separate 144-MHz-receive input, mandatory when using a tube-type amplifier and SPDT relay. (It's my understanding that the factory will make this option available on future models.) It would appear that hams in Great Britain (and possibly the rest of Europe) are accustomed to the transceive operation this unit offers. Most solid-state amplifiers use rf VOX keying also, and allow a single connection to the driving source, switching the amplifier in and out of the line.

Also on the back panel is a small access hole for adjusting the input-drive level. Those familiar with the older MMT units will welcome this access hole, for in the past you had to remove the top cover to set the drive level. The control complement is rounded out by the front-panel power switch on the left and the multifunction switch marked FREQUENCY SHIFT.

This switch also is a departure from previous models. What it does is to incorporate an offset oscillator into the transmit circuit so that you can work repeaters with your FM-equipped HF transceiver. Only the -600 offset is supplied as this is standard in Europe. With the switch in the NORM mode, your transmit signal is offset -600 kHz. In SIMP position, transmit and receive are the same. In REV position, your receive frequency is offset −600 kHz from the transmit frequency. This is similar to what we call a +600-kHz offset here, except we offset the transmit frequency instead. At this time, there is no provision for +600-kHz offset in Europe, so this switch functions as a repeater reverse switch.

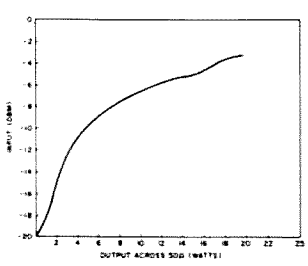


Fig. 1. Input drive vs. output power at maximum sensitivity.



Photo A. The MMT 144/28R transverter.

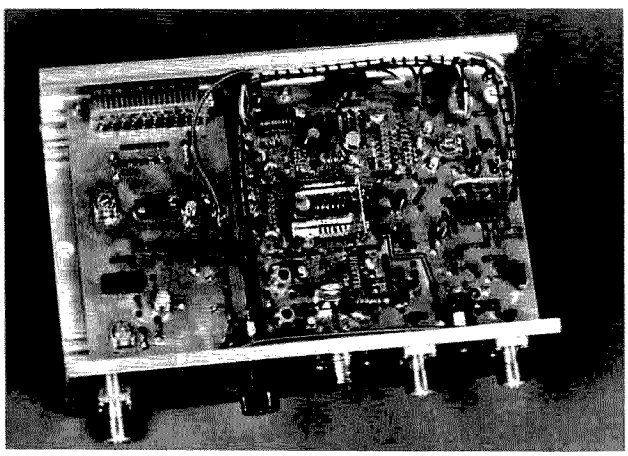


Photo B. Top view with cover removed.

One additional control I'd like to see is the addition of another switch to allow bandswitching the coverage from 144–146 MHz to 146–148 MHz. Ivars Lauzums KC2PX of The "PX" Shack says that this option is being studied and future units may be so equipped. As the unit comes, however, you can work FM simplex and access repeaters in the 145-MHz region using the standard −600-kHz offset. Of course, you could also replace the LO crystal with a 118-MHz unit and the offset crystal with a 117.40-MHz unit to allow this, but you'd give up use of the SSB and CW segments. Hence the request for a bandswitch.

The unit was put into service immediately and a marked improvement was noted on receive signals. The GaAsFET is not rated as far as gain goes, but initial tests over the air indicated it was at least 2 dB better than the standard MMT 144/28R, as far as noise figure goes. (We'll substantiate performance claims shortly.) The receiver displayed good performance in the presence of strong local adjacent signals, such as stations S9+60 dBm, 10 kHz away. Measurements bore this performance out in the lab.

Driving the unit with my ICOM 740 resulted in 23 Watts output power across 50 Ohms at 13.8 volts dc. I could not increase this output to the rated 25 Watts, and the input mixer appeared to be saturated at the given drive level. Subsequent conversations with Ivars resulted in the adjustment of the internal ALC circuit, which then yielded 25 Watts output. In fact, with a Bird 50-Ohm termination, I was able to increase output all the way up to 28 Watts but set it back to 25 which is more than adequate for my requirements. Since I use both solid-state and tube-type amplifiers, I need only 1 to 3 Watts of output and a step attenuator in series with the 28-MHz transmit input. This is switched out for QRP use or for driving a solid-state amplifier.

One peculiar problem cropped up early: After keying the circuit several times, it locked up in transmit. However, with the FREQUENCY SHIFT in NORM or REV, I was able to unlock the unit. Soon, however, these positions locked up as well. Careful study of the schematic resulted in clipping a diode to the offset oscillator circuit, and that did it. I was back on the air. It seems that the quad op amp LM324 used to effect the switching of the offset oscillator schemes blew up for some strange reason—perhaps none other than it was a defective chip. I replaced it with a new chip and installed a socket in case of future trouble, which hasn't occurred. This is a quirk the manufacturer is looking into.

After spending many hours working SSB and CW, I fooled a bit with the offset oscillators and worked several repeaters in the area in the 145-MHz range, getting excellent signal reports. Of course, this is no way to measure linearity, especially on FM! So, after arrangements were made, we trucked the units off to a local test lab to make some honest-to-Abe measurements using sophisticated equipment.

For the bulk of our tests, we em-

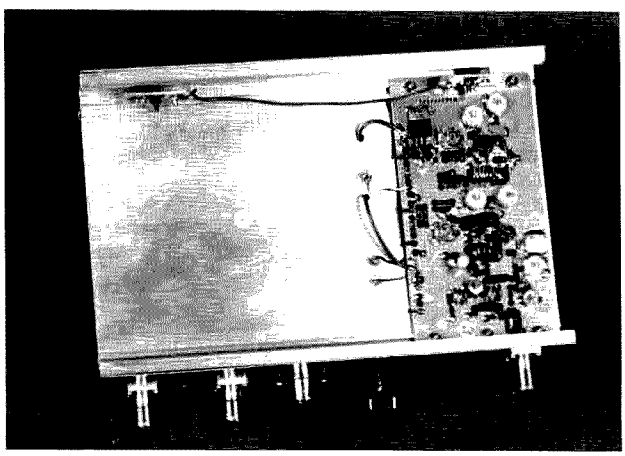


Photo C. Bottom view with cover removed.

ployed a Hewlett-Packard 8640B generator and 8554-141T analyzer. No noise-figure measurements were made, due to the lack of the right test equipment. The first test we ran was receiver conversion gain, claimed to be 22 dB ± 1 dBm by the manufacturer. We measured 19 dB at 144.0 MHz and 20.8 dB at 148 MHz. (A second unit measured 21 dB at 144.8 MHz.)

Sensitivity was found to be 0.07 uV for 10 dB S+N/N (−130 dBm)—more than adequate. In fact, excellent! But the associated problems of receiver crunching in the presence of a strong signal often come with high gain and sensitivity figures.

How did the MMT 144/28R do? We calculated the 1-dB compression point to be +6 dBm, which is very good for a GaAsFET front end. As a reference point, another manufacturer of preamplifiers in Europe sells a 144-MHz GaAsFET preamp with a 1-dB compression point of −4 dBm, indicating that likely it would have trouble with relatively strong signals encountered in everyday operation.

We found that the transmit section is relatively linear, although saturation occurred with an input of .4 mW for 17 Watts output. Fig. 1 shows input drive vs. output power. These tests were made using the signal generator directly into the 28-MHz input, and the output of the transverter terminated into a Bird 50-Watt Termaline resistor, and power was measured on a Bird 43 with 50-Watt 100–250-MHz slug installed. The second harmonic was down −48 dB from the reference signal, and the third harmonic down in excess of −60 dB. No spurs were evident. The transmit section complies easily with FCC regulations. These measurements were taken at both 10 Watts and 15 Watts output.

To anticipate your next question, we didn't measure gain of the front-end rf stage. But as you can see from the sensitivity and compression-point data, the front end is more than adequate for weak-signal work. This is one transverter that doesn't need a preamp in front of it. In fact, such a scheme would lead to degradation of the receiver performance, and unless you are trying to overcome 10 dB of feedline loss, I wouldn't recommend it.

Incidentally, the transverter uses a GaAsFET to drive the diode ring mixer, which helps dynamic range considerably over an active mixer. This is a common scheme

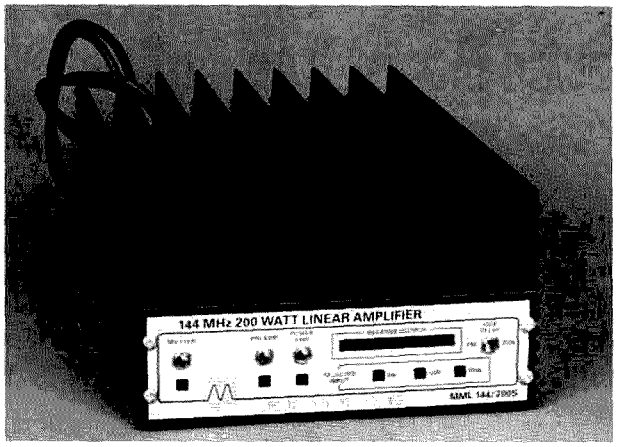


Photo A. The MML/200-S, 200-Watt, 144-MHz power amplifier.

on the newer HF transceivers and there's no reason why it can't work at VHF, either. It would appear also that MM has tamed the GaAsFET and made it a valuable addition to the VHF station. Based on actual over-the-air tests, I'd guess that the noise figure is probably under 1 dB with room to spare.

To sum it up, the MMT 144/28R represents a real step forward for the transverter user—not just in performance but in appearance and flexibility as well, what with the additional offset oscillators for FM work. The power output is sufficient for QRP work or for driving a higher-power amplifier, especially the newer grounded-grid types using 3CX800 tubes. These amplifiers typically need 20–30 Watts to attain full output, which has been a problem with the earlier transverters. Now you can set aside that intermediate amplifier!

Discussions with Ivars also reveal that some models of the MMT 144/28R can make as much as 45 Watts output with the ALC shut off, but this is risky operation. Surely the circuit can tolerate 30 Watts output, which is safely within the drive requirements of the 3CX800.

As regards the output, the heat sink is simply a thick piece of aluminum to which the PA stage is bolted. This piece of aluminum is contained within the transverter and appears to do a sufficient job of drawing off heat, but I'd still prefer an external heat sink that could be air-cooled—especially on a hot day!

The MMT 144/28R is available from *The "PX" Shack, 52 Stonewyck Drive, Belle Mead NJ 08502.* Price class: $350.

Peter H. Putman KT2B
Morris Plains NJ

POWER AMPLIFIER/ MICROWAVE MODULES

Many readers are familiar with Microwave Modules transverters and receiving converters. But MM also manufactures a fine line of solid-state rf power amplifiers for the VHF and UHF spectrum which are very popular in Europe. Continuing along these lines is the new MML/200-S amplifier for 144 MHz, with several interesting features.

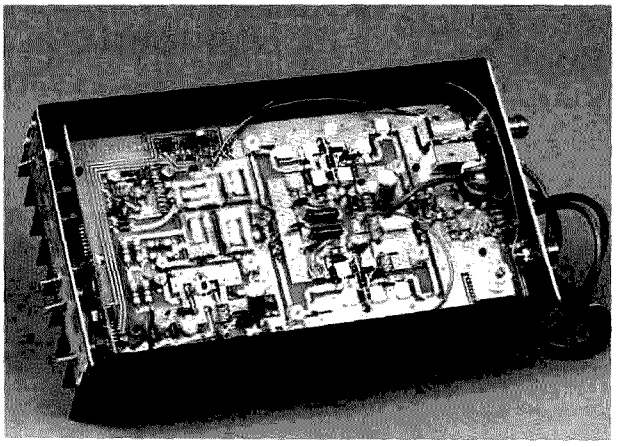


Photo B. Underside of the MML/200-S showing input-selector switch, lower right.

First of all, the heat sink is massive. This is one of the few high-power rf amplifiers I've seen that really can hold its power! It's big, all right, but you can still fit it in the trunk of your car, should you desire to go mobile. Front-panel layout is uncluttered, with separate switches for MASTER POWER, PREAMP ON, POWER AMP, and VOX DELAY. A front-panel LED bar-graph indicator shows relative output, and three other LEDs show the input mode selected (see Fig. 1).

A word about the input mode: MM has come out with a truly universal amplifier, and the user can select input sensitivity ranges of 25, 10, or 3 Watts. Now *that's* flexibility! Everyone from the FT-290 user to an IC-271 can run 200 Watts now with the same amplifier. The selection is made using a standard screwdriver to rotate a switch through a hole in the bottom cover in the rear of the chassis. In the 25-Watt position, the finals are driven directly. In the 10-Watt position, the driver comes into play with a fixed 50-Ohm attenuator ahead of it, and in the 3-Watt position, the input signal goes straight to the driver.

The transistor line-up features Thompson-type SD1275 in the driver with a pair of SD1477 finals operating into a hybrid Wilkinson power combiner. The gain of the final stage is 10 dB.

Fig. 2 shows the bottom of the amplifier and the PC board with the cover removed. Also included is a 12-dB GaAsFET preamplifier which is switchable from the front panel and is automatically switched when transmitting. The rf VOX circuit determines the drop-out delay, and is used only when the rf-sensing circuit comes into play. In my station I prefer to hard-key the amplifier through the rear-panel RCA jack, which is grounded for transmit.

Performance! Performance! I hear you screaming! Hold onto your hats, for this unit really makes the grade. Initially, I evaluated the receiver preamp section with Steve Katz WB2WIK, using Hewlett-Packard 8554-141T analyzers and an H-P 8640B generator. MM claims 12 dB of gain and deliberately minimized gain so as to not overload the front end of a multimode transceiver which would be used with the preamp. Good move!

This, of course, keeps compres-

25-Watt Range (Swr calculated at 1.75:1)

Calibrated Input	Measured Input	Measured Output
2.0	2.5	50
3.0	3.5	60
4.0	4.5	80
5.0	5.5	100
6.0	6.5	110
7.0	7.5	120
8.0	9.0	135
9.0	10.0	140
10.0	12.0	150
15.0	17.0	170
20.0	23.5	180
23.0	27.5	200

3-Watt Range (Swr not calculated)

Calibrated Input	Measured Input	Measured Output
.50	.45	100
1.0	.75	150
1.5	1.25	170
2.0	1.5	180
2.5	2.0	190
3.0	2.5	200

10-Watt Range (Swr calculated better than 1.1:1)

Calibrated Input	Measured Input	Measured Output
1.0	1.0	80
2.0	2.0	125
3.0	3.0	150
4.0	4.0	165
5.0	5.0	180
6.0	6.0	190
7.0	7.0	192
8.0	8.0	195
9.0	9.0	198
10.0	10.0	200

Fig. 1. Power-output tests. Drive source: ICOM 740 driving MMT 144/28R with step attenuator on 28-MHz transmit line. Dc power: ASTRON Model RS-35 35-Ampere, 14.0-volt regulated dc supply. Input calibration: Bird Termaline 25-Watt coaxial resistor. Output load: Cushcraft 32-19 Boomer (Type. Imp. 50 Ohms at 144.150 MHz). Input and output measured with Bird Thruline 43 wattmeters using 5-, 10-, 50-, 100-, and 500-Watt slugs. Input drive first calibrated into dummy load, then applied to MML 144/200. Input and output measured simultaneously. Dc voltage monitored, dc amperage unknown.

sion point high and also helps dynamic range. In our tests, we verified the gain to be 14 dB—a bit higher than claimed, but useful. The 1-dB compression point is +6 dBm, very good for a 144-MHz GaAsFET. This means the MML-200-S preamp will hold its own in the presence of very strong local signals. Sensitivity was calculated to be −124 dBm at 10 dB S+N/N. The minimum discernable signal (MDS) was −133 dBm.

Now, on to the power measurements. For these tests, I used an ASTRON RS-35 power supply set at 14.0 volts. The driving source was an MMT 144/28R transverter, excited by a Kenwood TS-430S. A step attenuator was put in line from the TS-430 to the MMT 144/28R. Next, I ran the output from the transverter through a Bird 43 wattmeter, using 5-W, 10-W, and 50-W slugs for calibration. Finally, the input went through a coaxial switch to either a 25-Watt Termaline load for calibration or the amplifier.

The output of the MML 200-S was monitored using a 50-Ohm load and Bird 43 with 100- and 500-Watt slugs. The reason I put the coax switch at the input with the dummy load is that inputs to solid-state amplifiers usually don't look like 50 Ohms, so my readings would have been falsified. Fig. 1 shows calibrated input power, measured input power, and output power in the 3-, 10-, and 25-Watt positions.

One thing that becomes evident right away is that the input to the final amplifier stage is not 50 Ohms. In fact, it calculates out to about 85 Ohms! That's not surprising in view of what I stated earlier. Remember that in this mode, your input signal drives the final stage directly. In the 10-Watt stage, the swr is excellent, but this is due largely to the resistive pad employed at the input to the driver. Here, calibrated and measured readings agreed each time.

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10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
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In the 3-Watt position, the swr appeared to be lower than 50 Ohms, probably around 25 Ohms. Here, your signal goes directly to the driver stage, and don't use anything more than an HT here! You could damage the driver if you hit it with 10 Watts of power. Again, use caution in selecting the desired drive range.

When was the last time you saw an amplifier that put out 200 Watts for 2.5 Watts of drive? Or, for that matter, 100 Watts output for 1/2 Watt of drive? (This amplifier ought to make happy those types who insist on using handie-talkies as mobile rigs.) We did not measure linearity, although on-air reports have been good. At no time was I able to get more than 200 Watts out of the amplifier, and at that output level the voltmeter still indicated 14 volts. MM rates the current consumption in this mode at 30 Amperes, so the RS-35 can do the job nicely.

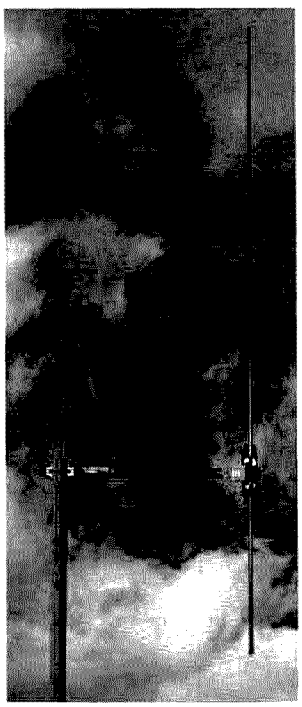
In this particular model, the rf VOX keying didn't work at all. I'm not sure what caused this problem, but the unit I obtained was one of the early production models, so I must assume component failure. One other area of complaint is the method used to connect the front panel to the internal circuit board: The panel uses a 7-pin inline socket, much like half an IC socket, while the circuit board has a mating plug.

Unfortunately, there is no way to see if these two parts mate when attaching the front panel, so I spent nearly a half-hour after making the receiver tests trying to get the panel back on and make contact. Conversations with the US importer indicate that this method of connection has been changed to a flexible ribbon cable. At least the folks at MM are responsive to complaints!

This is indeed a clever amplifier, and one which any 144-MHz operator would love to have in his or her station. The advantage of being able to custom-tailor your input-drive requirements make it only that much more desirable, and it takes care of the need for a high-power amplifier for SSB/CW and FM simplex work. I'd venture to guess that it would also work nicely in repeater service, derated to the 100-Watt level with a small cooling fan. That is indeed an enormous heat sink!

Price class: $400. US importer: *The PX Shack, 52 Stonewyck Drive, Belle Mead NJ 08502.*

NEW PRODUCTS



The Omni antenna.

AN IMPROVED OMNI FROM GROVE

The Omni, developed by Bob Grove and now improved, is a non-directional vertical dipole with continuous 30–960 MHz coverage. A single 66-inch element works on the harmonic principle to provide in- and out-of-band scanner reception throughout the VHF/UHF spectrum.

Low band, high band, UHF, military and civilian aircraft bands, and cellular radio telephone, all can be received on this one antenna. All mounting hardware is included. Requires a TV type-F connector on your coax.

For further information, contact *Grove Enterprises, Inc., PO Box 98, Brasstown NC 28902; (800)-438-8155.*

NEW SLIMLINE OHMMETER BY NES

The new addition to the Slimline series of digital panel meters allows reading resistances never before possible. With the high resolution, stability, and accuracy of this latest product, you can determine if just one turn of a winding (motors, transformers) is shorted. The contact resistance of a switch, relay, or connector, can easily be measured.

The Slimline ohmmeter uses high-stability, amplifier circuits to permit better accuracy and stability than most laboratory units. These integrated circuits and techniques are the same ones used in the past in medical electronic-monitoring equipment. The ohmmeter is capable of the 4-wire- or 2-wire-measurement technique. With the 4-wire approach the extra two wires allow automatic compensation of all wire, connector, and switch resistances in the measurement path. The 2-wire approach allows manual zeroing of the path's resistance. There are many proponents of each; both have their advantages.

As with all Slimlines, the meter mounts on the front of the panel only. The meter measures 3½ x 4½ x ¾" and can be adapted easily for programmable controller or computer interface. Parallel or strobed BCD, serial ASCII, RS232, or RS422 are all available. This allows an easy way to grow into an automation test or CAM system.

As with all NES meters, the Slimline ohmmeter is backed by a full 3-year unlimited warranty.

For more information or application assistance, call or write: *NES, Inc., 3003 Wakefield Drive, Carpentersville IL 60110; (312)-426-5900.*

UNCLE BILL'S SOFTWARE CODES AND ANTENNAS

Uncle Bill's Code Course is a Morse code training program designed for the Commodore C-64 and C-128 computers. The Code Course is very user friendly. The program is broken into three parts, allowing instruction at any level from beginner to professional.

Part 1 introduces each character by calling for the student to press a key, then hear the properly sent Morse code equivalent and view the character on the screen. The sight and sound combination is used for emphasized (dual sensory) learning.

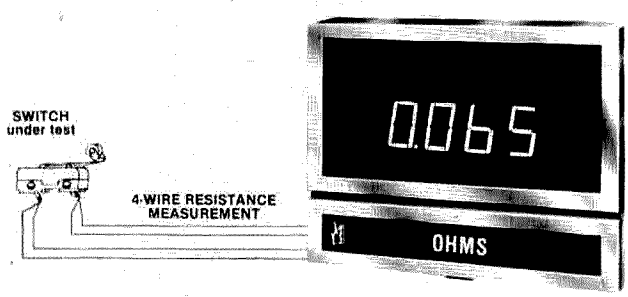
Part 2 sends a properly formed Morse character and requires the student to respond by pressing the appropriate key. If an incorrect response is made, the character will be resent. This will continue until the proper response is made, or a special key is pressed to assist the student. At the end of each session in this part, the computer will grade the student's progress.

Part 3 sends properly formed Morse characters in random groups of five characters each. The sending speed is selectable from 5 GPM to 20 GPM. This part gives the student practice at writing down what he hears. The student's written responses may later be checked for accuracy by viewing the screen. The computer will send these groups until told otherwise, not just one group at a time.

Random code groups were selected, as they are the most difficult to "copy." Mastering of this section will enable the passing of any code test given, including the commercial Radio Telegraph Operators test.

All Morse is sent at 20 WPM. Hence, the student has only to learn character sounds once. This method is sometimes referred to as the Farnsworth method. Varied sending speeds in Part 3 are attained by adjustable spacing between the characters.

Operating instructions are in-



The NES Slimline ohmmeter.

cluded as a part of the program, and are carried on the screen.

Antenna System

Uncle Bill's "Antenna System" is an antenna modeling and design package usable for planning HF antennas of most types. It is very user friendly and has helpful graphics. The program is broken into two parts.

Part 1: Designs standard (full size) antennas of horizontal, vertical and yagi types. Merely enter the frequency you wish to design an antenna for, and the screen will fill with all the necessary dimensions for proper planning. Ask the computer for a display, and a model of your selection will be shown graphically, complete with dimensional labels.

Part 2: Designs dipole antennas of reduced size for the ham who does not have the necessary lot size for full-sized HF antennas. The operator has only to enter the frequency of planned operation and answer a few questions about his own circumstances (all menu driven). Based upon the responses, a computer model of a custom designed antenna will be displayed. All dimensions are given with the graphics model. The "Antenna System" is particularly useful for designing 80- and 160-meter antennas.

Operating instructions are included as a part of the program, and are carried on the screen.

For further information, contact: *Uncle Bill's Fine Software, PO Box 2403, Falls Church VA 22042.*

THE LISTENER'S HANDBOOK FROM GROVE

Two of the most popular Grove books were Bob Grove's *Communications Monitoring* and *Behind The Dial*, now out of print.

The basic subject material has been taken from those two books, extensively reorganized, updated, and supplemented, with new illustrations and photos. The result is *The Listener's Handbook*, by Bob Grove.

Virtually every topic of interest is explained in Bob's easy-to-understand manner. Subjects include the radio spectrum and its users; security and surveillance equipment and techniques, including scrambling; how to choose a receiver; selecting the best antenna for your installation; all about coax cable, preamplifiers and preselectors; interference and its cures, and other topics.

For the do-it-yourselfer, Bob has included a special home projects section with easy-to-build filters, tuners, receivers, descramblers, *antennas*, power supplies, converters, amplifiers, and other essential accessories for the serious listening hobbyist.

Containing 94 pages (softbound, 8-1/2 x 11) and more than 100 illustrations, charts, and tables, *The Listener's Handbook* is a reference for any listener to the first 1,000 megahertz of the radio spectrum.

For further information, contact *Grove Enterprises, Inc., PO Box 98, Brasstown NC 28902.*



Yaesu's YS-60 meter.



Yaesu's YS-500 meter.

MONITORING TIMES GROWS TO 40 PAGES

Monitoring Times, the comprehensive and timely tabloid on monitoring the total radio spectrum, has now grown to 40 pages at no additional increase in subscription cost.

MT covers VLF to microwave, BBC to satellites, law enforcement radio to private broadcasters, aircraft to ships at sea, for complete listening coverage. Free sample available upon request to the publisher, *Grove Enterprises, Inc., PO Box 98, Brasstown NC 28902.*

RF NOTES #2

RF Notes No. 2 is the second in the series of rf design-aid programs for problems frequently experienced in radio frequency design. RF Notes No. 2 contains four programs and can aid in such activities as "Inductor Design." Single-layer coils, both close- and space-wound, and Toroid coil design. "Complex Impudence Matching Circuit Design includes L, PI, T, and wideband configurations. "Attenuator Pads," designs 11 different pad configurations. Additionally, a short program, "Capacitor Application Evaluation," is included. Color or monochrome, *for IBM* 128K, graphics card required. For more information, call or write Etron RF Enterprises, PO box 4042, Diamond Bar CA 91766; (714) 594-8471.

YAESU HAS TWO NEW IN-LINE METERS

Yaesu Electronic Corporation announces two new in-line swr and power meters. The YS-60 measures both average and peak power output, reflected power, and vswr in the range from 1.6 to 60 MHz. The YS-500 performs *the* same measurements covering the 140-to-525-MHz range. Three functions provide monitoring of either forward or reflected average transmitter output power for CW, AM, FM and FSK modes, and vswr for testing the performance of antennas. The linear circuit design assures accurate measurements with minimum insertion loss over the entire specified frequency range, even at low power levels.

For further information, contact any Yaesu dealer or Yaesu Electronics Corporation, PO Box 49, Paramount CA 90723.

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NEVER SAY DIE

from page 4

So, what have you found to work best in spreading HI? Has anyone found demos in *shopping* malls to do anything? Most of the ones I've seen have kept the public so far away that they couldn't see, hear, or understand what was going on. There's a self-destructive drive to show off esoterica such as slow-scan or RTTY at fairs and malls. These are just ego-gratification exercises. If we want to get HI around we may do better to stick to simple things like voice communications and rag-chewing. What've you found?

To change metaphors, I think you *may* find that it's important both to expose and re-expose the potentially infected to the virus. It's sort of like getting them to take the bait, then setting the hook.

In my case, Fred had me baited, but the hook didn't really set until about five years later when someone gave me a box of radio parts. There were enough for me to build a radio circuit out of Popular Mechanics. The hook was set—permanently. So let's hear it on how you got caught up in amateur radio. Did you go for the bait and get hooked like I did? We can learn how to spread our joy to others if we share our experiences.

Yes, I know, you've probably never written to an editor before. Well, that sort of irresponsibility doesn't wash with *73*. When you send in your subscription you're just getting started here. I expect you to join me and the others to get some recognition for the hobby, to get more hams, and to help get us back to where every major communication development has been invented and pioneered by hams, the way it used to be before 1963.

Did a ham magazine have much to do with your getting licensed? If so, try to remember what it was that did it to you. Let me know so I can do it some more. I can make *73* any way I want it, and what I want is to make it so it's got what you want to read and will help amateur radio to grow. Let me hear from you.

WHILE YOU'RE WRITING

One thing that is never far from my mind is getting a *new piece of* ham gear. So, like you, I read over the ads carefully. Since the smaller the type, the better the bargain, I tend to get out my magnifying glass and go over the dealer ads with particular care. But I find myself getting confused. Oh, I know most of the model numbers, but not all. And I remember some of the recommendations I've gotten over the air, but I'm not so sure about some of the gear I'm interested in buying.

What I'd like to see is a regular listing—maybe quarterly—of what you think of all that ham gear you've bought. If you'd just go through your ham shack, list the gear you're using and let me know how you like it—say, on a scale from zero to nine—I'll tote up the votes and run them in *73*, listing the make, model, number of votes, and average score. Sure, I expect a manufacturer will send in a nine for his equipment, and his competitor will send in a zero. But by the time we have a few hundred votes, we'll have a very good idea *of where* truth lies.

Another thing. I enjoy reading the reviews of new products as much as you do. But I'd much rather know the opinions of a dozen or so active hams who bought the unit, after using it for a few weeks, than the opinion of some joker who is writing to make money and who doesn't want to make the manufacturer mad by being too critical. I want to know what the average ham thinks of the product—what you think of it. So, the next time you buy a new piece of gear—an antenna, a rig, an HT, test equipment, or anything else—once you've used it for a while and know its good and bad points, how about dropping me a letter and telling me what you've found? If I print it I might just extend your subscription a month or two—maybe a year, if I find your opinions particularly interesting. Mostly you'll be doing it either to help other hams avoid a bad experience or to help a manufacturer who has brought out something worth knowing about. Here's a chance to talk about ease of use, instructions, damned-fool dials, weird connectors, good signal reports, and so on. We're supposed to be communicators, so let's communicate!

Most of us will be particularly interested in what you think of the products which are currently being advertised in the ham magazines. But I think we also will be interested in older products, *ones* we see at flea markets and ham auctions, so don't figure it's too late once something has been out for a year or so. Heck, I'm still seeing Gonset Communicators selling at Dayton!

Once I'm able to get your Home Test Report into *73*, I'd like to set up a place on the reader-service *card for everyone* to vote for the most helpful report of the month, with perhaps a $100 reward for the winner. I believe that good actions should be rewarded.

Send your reports to Home Test Reports, *73* Magazine, WGE Center, Peterborough NH 03458. And, yes, I want to hear from hams anywhere in the world.

AND ANOTHER THING. . .

The word is that a few of you have been busy doing more than just rag-chewing. I don't put much stock in these reports, but just in case you have been playing around with some crazy things like slow-scan, RTTY, satellites, moonbounce, or such, know that I want to hear more about what you're doing and, if you know, why you're doing it.

It's been years since I used RTTY, so I hardly know where to start today. What do you recommend I buy? Do you have to build anything? Who's on the air for me to talk with? How about contests? How many get involved and what does it take to win? How many countries can I hope to work on RTTY these days? How many standards are there? Do I use the old five-bit code, ASCII, or what? My old 1948 RTTY gear should probably be in a ham museum now.

Is there any reason for me to get going on slow-scan again? I tried that *around* 15 years ago *and* had a ball. But then, like most everyone else, I got bored with the lack of program material from others—and lazy in making my own. I remember a chap getting DXCC on slow-scan—how many countries might I work today if I had a good station? Are any DXpeditions dragging along slow-scan equipment? I remember making SSTV contacts when I operated from KC4DX on Navassa back in 1972, and also from Amman as JY8AA, and also from JY1 in 1973.

What's my best bet in gear to work through OSCAR these days? My old 432/145-MHz 1975 setup is long gone. My best DX was Moscow, where I had a 20-second window one day. That took some doing—and luck. But what should I get now to get on with a good signal? If you're working the satellite with some success, let me know what I need in a rig, a receiver, and antennas.

One of my great enthusiasms around 15 years ago was cross-band repeater operation. I had WR1AAB set up on our nearby Pack Monadnock mountain, with cross links to six and ten meters. With that, the local two-meter gang was able to make lots of contacts all around South America. I had another repeater setup at home linked to twenty meters. The FCC scotched that for a few years, but now it's blooming again and I'd like to know what you're doing along this line. Who knows, I might be in your neighborhood and want to see what I can work. I get around a lot—a whole lot.

So if you're having fun with some special ham interest, tell me



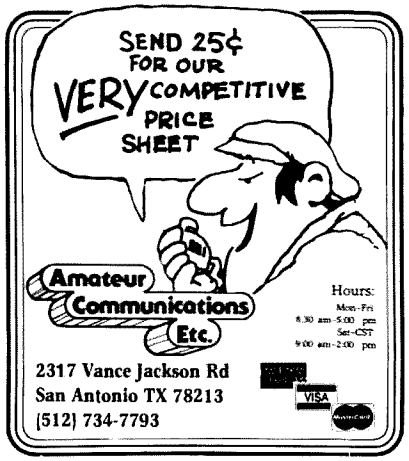
Hmmm, that paunchy chap on the left has been dipping into too many dim sum. That's me with Tim Chen BV2B in the middle and Ken Miller K6IR on the right. Ken and I have been visiting Tim every October for a while while on a round of Asian consumer electronics shows. As a matter of fact a surprising number of hams are on the trip with us—which makes it all the more fun. Maybe you worked Tim or his recent visitor, Barry Goldwater, during their January stint.

and the other 73 readers what you're doing, why it's fun, and how we can join in the fun. What can we build? What can we buy? What short cuts are there to save some money or time? How about some references to good information sources?

GOOD HELP

If I'm going to get *73* back into shape, I'm going to need a lot of help. I know some things to do and you'll tell me more, but I'm looking for someone for my staff who can make my W2NSD/1 ham station really sing. I want to work with someone to help me get active on OSCAR again, to get on RTTY again, and to see what I can do with packet radio. If you know of someone with some experience in some of these things and who would like more than anything else to make hamming a life's work, someone with some technical smarts—any age, any sex, any race, any religion—pass the word!

Look out *Ham Radio*! Look out *CQ*! *73* is going to do those things which should be done so you won't want to miss an issue—and maybe we can get amateur radio itself moving again. We have the greatest hobby in the world, and that's not just puffery. Our hobby is the key to getting our country back into the act in consumer electronics, so you and I have a responsibility. We've got to make amateur radio and the fun it provides known. I need your help to do this. If we can work together, nothing can stop us!



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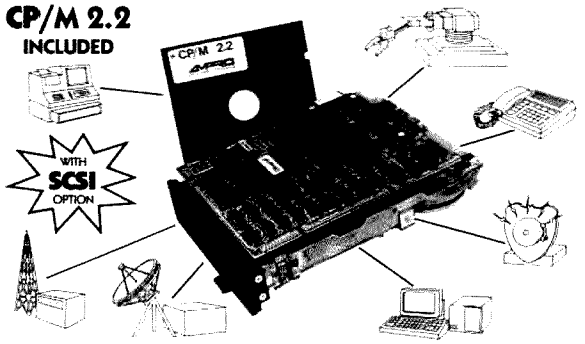
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FL6/1500	1000	55 MHz	63 MHz	70 db	6 meter	$36.00*
FL6/100	100	55 MHz	63 MHz	50 db	6 meter	$25.00*

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DX CONTEST—PHONE ARRL INTERNATIONAL
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Ends: 2400 UTC March 2

This annual DX contest for all DX hunters is sponsored by the **ARRL** and open to all amateurs worldwide. W/VE amateurs are to work as many amateur stations in as many **DXCC** countries as possible on **1.8** to **30 MHz**, excluding the 10-MHz band. Foreign amateurs are to work as many W/VE stations in as many states and provinces as possible. Check *QST* for any last-minute rule changes. Operating categories include:

(A) Single Operator—one person performs all operating and logging functions. Spotter nets are not allowed and only one transmitted signal may be used at any given time. Within the single-operator category, participants may compete within all band or single-band categories as well. Single-band entrants who make contacts on other bands should submit logs for checking purposes.

(B) Multi-Operator—more than one person operates, checks for duplicates, logs, etc. Within this category, entrants may compete within single-transmitter, two-transmitter, or unlimited-transmitter categories. Single transmitter implies only one transmitted signal at any given time and once station has begun operation on a given band, it must remain on that band for at least 10 minutes. Listening time counts as operating time. Multi-op single-transmitter stations must keep a single, chronological log for the entire contest period.

Two-transmitter multi-op entrants are limited to only two transmitted signals at any given time. Again, each station must stay on a given band for a minimum of 10 minutes. Both transmitters may work any and all stations; the second transmitter is not limited to only working new multipliers. Each of the transmitters must keep a separate log.

With an unlimited number of transmitters for multi-op entrants, only one transmitted signal per band is permitted at any given time. Separate, chronological logs must be kept for each band.

(C) **QRP**—10 Watts input or less (or 5 Watts output or less), single operator, allband only.

Operators must observe the limitations of their operator licenses at all times. Your callsign must indicate your DXCC country station location. One operator may not use more than one callsign from any given location during the contest period. The same station may be worked only once per band; no crossmode, crossband, or repeater contacts. Aeronautical- and maritime-mobile stations outside the US and Canada may not be worked for QSO or multiplier credit by W/VE stations. All transmitters and receivers must be located within a 500-meter-diameter circle, excluding directly-connected antennas. This prohibits the use of remote receiving installations. However, multi-operator stations may use spotting nets for multiplier hunting only.

EXCHANGE:

W/VE stations send **RS** and state or province. **DX** stations send **RS** and power as three-digit number approximating transmitted input power.

SCORING:

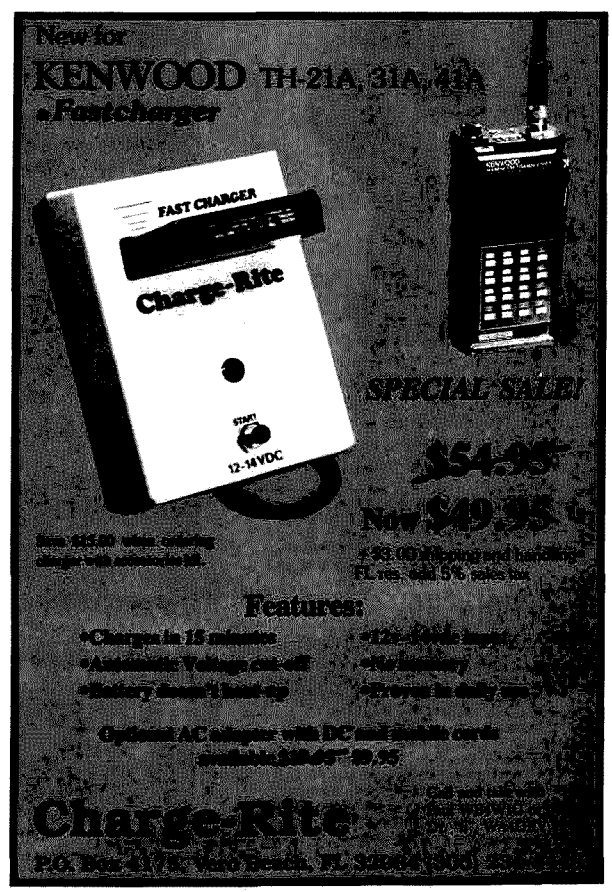
All stations count **3** points per valid QSO. W/VE multiply QSO points by sum of DXCC countries (except US and Canada) worked per band. **DX** stations multiply QSO points by number of US states (except KH6/KL7) and District of Columbia (DC), VE1–7, VO, and VE8/VY1 worked per band (58 maximum per band).

AWARDS:

Plaques awarded to top W/VE scorer in each entry category; top scorer in the single-operator all-band category worldwide and on each continent; worldwide leaders in the single-operator single-band, QRP, multi-op single-transmitter, multi-op two-transmitter, and multi-op unlimited categories—plus additional special plaques as sponsored. Certificates will be awarded to top single-operator, allband entries from each country and **ARRL** section; top single-band entries in each US call area and each country; top multi-op entries in each country, US call area, and in Canada. Additional single-band and multi-op certificates will be awarded if significant effort or competition is displayed. Also, DX entrants making more than **500** QSOs on either mode will receive certificates. **ARRL** affiliated clubs also compete for gavels on three levels: un-

CALENDAR

Mar 1–2	ARRL International DX Contest—phone
Mar 8–10	Virginia State QSO Party
Mar 15–16	YL-ISSB QSO Party—CW
Mar 15–16	Bermuda Amateur Radio Contest
Mar 29–30	Rio CW DX Party
Apr 12–13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
May 31–Jun 1	National 6-Meter Invit. Net Activity Day Contest
Jun 7–8	ARRL VHF QSO Party
Jun 28–29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12–13	IARU Radiosport Championship
Aug 2–3	ARRL UHF Contest
Aug 16–17	New Jersey QSO Party
Sep 13–14	ARRL VHF QSO Party
Oct 11–12	Rio CW DX Party
Nov 1–2	ARRL Sweepstakes—CW
Nov 15–16	ARRL Sweepstakes—phone
Dec 5–7	ARRL 160-Meter Contest
Dec 13–14	ARRL 10-Meter Contest



limited, medium, and local clubs.

ENTRIES:

All entrants are encouraged to use official forms available from ARRL headquarters to report contest results. Logs must indicate times in UTC, bands, calls, and complete exchanges. Multipliers should be clearly marked in the log the first time worked. Entries with more than 500 total QSOs must include cross-check sheets (dupe sheets). All operators of multi-op stations must be listed.

Entries must be postmarked within 30 days of the last contest weekend, otherwise they will be classified as check logs—no extensions, no exceptions. All stations are requested to send their entries in as early as possible. Each entrant agrees to be bound by the provisions of the ARRL rules, licensing authority, etc. The decisions of the ARRL Awards Committee are final. Usual ARRL disqualification rules apply. Address entries and forms requests to ARRL Headquarters, 225 Main St., Newington CT 06111.

VIRGINIA QSO PARTY
Starts: 1800 UTC March 8
Ends: 0200 UTC March 10

The 1986 QSO party is again sponsored by the Sterling Park Amateur Radio Club of Sterling Park VA. The same station may be worked on each band, once on each mode. VA stations may contact in-state stations for QSO and multiplier credit. VA mobile stations must sign as mobile and may be worked in each new county they operate from for new QSO and multiplier credit regardless if previously worked on the same band and mode in another county. Stations on county-line borders count for only one QSO regardless of the number of multipliers they offer. QRP stations must run 5 Watts or less for their entire operating time.

EXCHANGE:

QSO number starting with 001 and QTH consisting of state, province, DX country, or VA county. VA stations note that the reference for valid counties is the *CQ's Counties Award Record Book*, which lists a total of 95 counties.

FREQUENCIES:

Phone—3.930, 7.230, 14.285, 21.375, 28.575, and anywhere on 160-meter band except in DX windows. CW—60 kHz up from the low end of each HF band and anywhere in 160-meter band or Novice subbands.

SCORING:

Count one point per voice QSO; two points per non-voice QSO (RTTY, CW, SSTV). No cross-mode QSOs. VA stations multiply total QSOs by the sum of states, Canadian provinces, DX countries, and VA counties worked. Others multiply QSOs by the number of VA counties worked. VA mobiles may count fixed stations only once as multipliers. VA stations vying for the CW-only award will have only CW contacts and multipliers counted.

AWARDS:

Engraved plaques to the top-scoring stations in the following categories: High VA single operator (fixed location, multimode); high VA CW-only station; high VA mobile; high out-of-state (including DX) station; high VA QRP station; high 4th call area club award; and high out-of-state station. Certificates awarded to winners of VA counties, states, Canadian provinces, and DX countries.

ENTRIES:

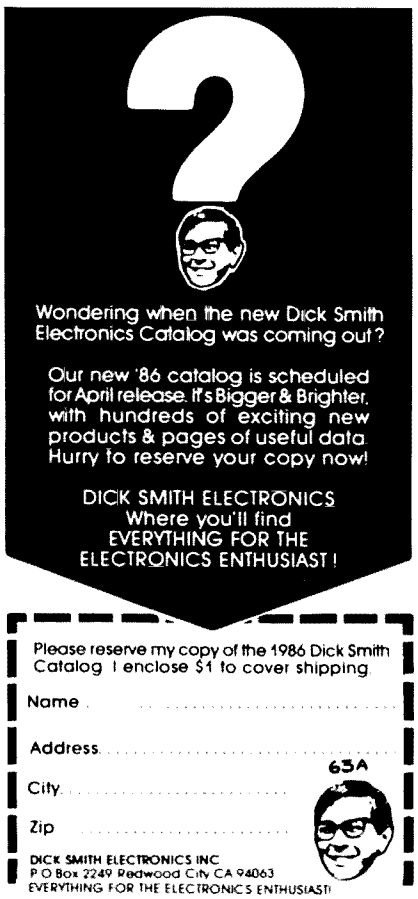
Follow ARRL standard contest guidelines for logs. Indicate each new multiplier as worked and include a summary sheet with your log. Indicate on summary sheet if mobile, QRP, or if entering for CW-only award. Put your name, callsign, complete address, and name of your radio club (if vying for the club award) on the entry forms. Mailing deadline is April 1, 1986, and should be addressed to: Virginia QSO Party, c/o Barry Pybas KW4I, 313 W. Derby Ave., Sterling Park VA 22170.

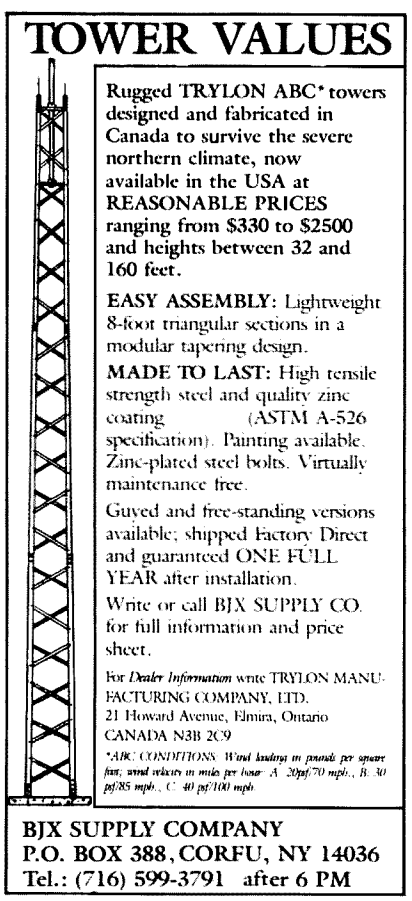
WISCONSIN QSO PARTY
Starts: 1800 UTC March 9
Ends: 0100 UTC March 10

Use both CW and phone; stations may be worked once per mode on each band. Mobiles may be worked once per mode per county that they operate from. No repeater QSOs allowed! Entry classifications include: single operator, single transmitter; multi-operator, single transmitter; multi-operator, multi-transmitter; single operator, Novice/Technician.

EXCHANGE:

RS(T) and state, province, or WI county.







FREQUENCIES:

Phone—3.890, 7.290. 14.290; CW—3.550, 3.275, 7.050, 7.125, 14.050, 21.150.

SCORING:

Phone contacts count 1 QSO point; CW contacts count 2 QSO points, Wisconsin stations multiply QSO points by total number of states, provinces (13 max.), and WI counties. DX countries count for QSO points but not multipliers. Non-WI stations multiply QSO points by number of Wisconsin counties (72 max.). As a bonus, WI mobiles/portables add 500 bonus points for each county that you operate form outside your home county with a minimum of 15 QSOs per county to qualify.

AWARDS:

Awards will be presented to the highest single-operator scores in each state and province. Wisconsin awards to 10 highest single-operator entries plus highest multi-operator single- and multi-transmitter entries, highest Novice/Technician, and highest aggregate club score. Club member stations must be located within 50 miles of the club except for mobiles.

ENTRIES:

All entries must contain a log consisting of: time in UTC, call, RS(T), state, WI county, mode, and a score summary. Summary must include your name, address, and callsign. Circle new multipliers as worked. Logs containing more than 100 QSOs must be accompanied by a dupe sheet (use a separate dupe sheet for each mode). Mobile entries must indicate county changes in log and submit a separate dupe sheet for each county. Entries must be postmarked by April 15 and sent to: Wisconsin QSO Party, c/o West Allis Radio Amateur Club, PO Box 1072, Milwaukee WI 53201.

BERMUDA AMATEUR RADIO CONTEST
Starts: 0001 UTC March 15
Ends: 2400 UTC March 16

This is the 28th year, again sponsored by the Radio Society of Bermuda. The contest is open to all licensed amateurs in Canada, USA, United Kingdom, and the Federal Republic of Germany. Of the 48-hour contest period, your total operating time cannot exceed 36 hours, with off periods clearly logged. Each off period must not be less than three consecutive hours. All stations must be single operator only and must be operating from their own private residence or property. All use bands, 80 through 10 meters. No crossband or crossmode contacts are permitted.

EXCHANGE:

All stations will send RS(T) reports and give the following: Canadians add province, UK stations add county, US stations add state, West German stations add DOK#, Bermuda stations add parish. US and Canadian stations may exchange reports with West German, UK, and Bermuda stations only. UK and West German stations may exchange reports with US, Canadian, and Bermuda stations only. Bermuda stations may work stations in the UK, US, West Germany, and Canada only.

SCORING:

Each completed contact, on each band, counts 5 points. A phone and a CW contact with the same station on the same band will count if they are made at least 30 minutes apart. For all stations outside Bermuda, the multiplier is the total number of Bermuda stations worked on each band. For Bermuda stations, the multiplier is the total number of states, provinces, countries, and DOK# worked on each band. A multiplier may be counted only once per band.

AWARDS:

Printed awards to the top scorer in each state, province, country, and DOK area. The top scorer in Canada, US, UK, and West Germany shall receive a trophy to be awarded at the Society's Annual dinner held in October of each year. Round trip air transportation plus accommodation will be provided to overseas winners to enable them to receive their awards.

ENTRIES:

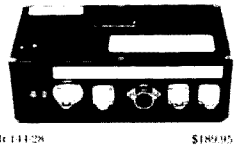
Logs must show all dates and times in UTC. A separate sheet must be used for each band. All contestants should compute their own scores and check for duplicate contacts. Dupe sheets must be submitted with logs to cover each band where more than 200 contacts are logged. For every duplicate contact for which points are claimed, a penalty or three contacts will be deducted by the contest committee. An excess of claimed duplicates may mean dis-



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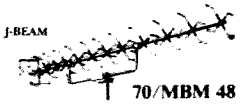
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qualification. No penalty will be exacted against duplicates for which no points are claimed. Each page must be clearly numbered and marked with contestant's call, year, and band to which it refers. All contestants must sign a statement that they have complied with the rules and terms of their license. All logs must be received by the Contest Committee, Radio Society of Bermuda, Box HM275, Hamilton 5, Bermuda, not later than May 31. Overseas contestants are recommended to forward their logs via air mail. All decisions of the contest committee are final. Bermuda Parish abbreviations are as follows:

SAN—Sandys
PEM—Pembroke
SOU—Southampton
HAM—Hamilton
STG—St. George
DEV—Devonshire
WAR—Warwick
SMI—Smiths
PAG—Paget

YL ISSB QSO PARTY—CW
Starts: 0001 UTC March 15
Ends: 2359 UTC March 16

The contest is open to all amateurs but the emphasis is on member participation and member-to-member contacts. Operating categories include: single operator, DX/WK partners, and YL/OM teams. All bands will be used. VHF and UHF may be used, but all contacts must be direct and not through repeaters. Nets are not allowed!

EXCHANGE:

RST signal report. State, province or county, name; ISSB number (if member), and DX/WK partner's call.

FREQUENCIES:

On HF use the USA General-class band portions. Check 80 and 40 meters on the hour.

SCORING:

Score 3 points for each member contacted on own continent, 6 points if different continent. Non-members contacts count one point regardless of location. Only member station contacts count for multipliers. Multipliers are each US, VK, ZL, and VE state or province, plus each DX county. When DX/WK partners contact each other, it counts as a double multiplier. If your total input is 250 Watts or less during the entire QSO party, then count an additional power multiplier of two. Final score is sum of QSO points times the total multiplier.

AWARDS:

Special certificates will be awarded to the winners of each category. Regular certificates for country, US state, and Canadian province winners.

ENTRIES:

Logs must show date/time (UTC), station QSOed, RST, mode, band, SSBer number, state/province/country, and period of rest time. Summary sheets show states, Canadian provinces, countries, YL/OM teams, DX/WK teams, and partner contacts. Send logs and summary sheets to Bill Early WA9AWA, PO Box 401, McHenry IL 60050-0401, prior to April 30. Be sure to indicate who your DX/WK partner is!

RIO CW DX PARTY
Starts: 1500 UTC March 29
Ends: 1500 UTC March 30

Sponsored by the Pica-Pau Carioca (Rio Woodpeckers CW Group), PO Box 2673, 20001 Rio de Janeiro, RJ, Brazil—with the cooperation of all other Brazilian CW groups. The purpose is to promote 2-way CW contacts between Brazilian and DX stations, enabling DX stations to obtain QSLs valid for several Brazilian Awards. The event is held twice each year on the last full weekend in March and the second full weekend in October.

The general call is "CO RIO DX PTY." Use all HF amateur bands within your own station license authority. Exchange RST, name, and QTH. There are no logs, but quick QSLing (via bureau or direct) is essential.

Reference frequencies are as follows: 3.510/3.520, 7.020/7.030, 14.030/14.050, 21.030/21.050, 21.130/21.150, 28.030/28.050.



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You know, sometimes it occurs to me that month after month I have been asking you for input on what you all consider important RTTY topics. I get quite a kick out of your letters and try to answer every one of them. What I have failed to do, however, is let the rest of you in on what your vocal (prolific) buddies have been saying.

One of you, who shall remain nameless for reasons that will become obvious, writes that he has "obtained" a copy of Clay Abrams' RTTY program, detailed here last month, and wonders where he might obtain instructions for the program. Well, if you did not receive instructions with the copy you obtained, I will assume you obtained a "bootleg" copy, that is, one made for you by a buddy, and not bought from Clay. You see, that's the problem. The number of copies circulating is so many more than the number of copies sold that Clay decided that staying in the CoCo software line was more an act of charity than business, so he left.

If you or anyone else who wants full data on the Abrams program has a sudden attack of conscience, you might drop Clay a note at Clay Abrams Software, 1758 Comstock Lane, San Jose CA 95124. Explain your situation to him and see what he says. Of course, I am sure he would be happy to hear from those of you who do not yet own a copy of the program, and who would like to buy a copy.

Congrats to Patrick Spinler KA0UBM, a new Novice licensee out in Blooming Prairie MN. Patrick is an Apple buff who would like to take a shot at writing a RTTY program for the Apple that would have all the features a ham would want. Patrick wants to know what features we would like to see in an "ideal" program. Well, folks, shall we inundate him? No, seriously, Patrick, read along with this column over the last few, and coming, months, and I think you will get the ideas you are looking for. And when you get it together, let me know, so we can share it with the multitudes, okay?

Dave Machlitt, a consulting entomologist (I wonder if he is good at debugging programs) in Ventura CA passes along the newsletter of his local computer club. With quite a bit ofinterest in both the CoCo and C-64 computers evident, it looks like activity with these "low-end" machines continues unabated. Thanks for the information, Dave.

Speaking of C-64s, Richard W. Keusink K7VPL lets us know that several of the items he has bought after reading about them here in "RTTY Loop" have turned out quite well, particularly some of the AEA gear. He has some specific questions, however, which I cannot find answers to, so I will throw them out to you. He asks, "On bringing up the AEA CP-1 program, must I boot it up every time to get the separate QSO buffer; one of the nine message buffers? Can't I bring them all up at the same time? What good is my 1541 (disk drive)? Maybe I'm not storing the material correctly? I also can't load a message port to put in a guy's call without leaving the TR mode. Other hams do it. How do I do it? If I leave the TR mode, of course, I lose all the print. There must be some way to achieve this."

Well, gang, any answers? Drop them to me at the above address, and put "CP-1 Help" on the outside of the envelope so I'll be able to forward the material promptly.

Richard is also interested in locating press wireless signals, such as AP or UPI, on the HF bands. One of the problems you will have in finding press signals for domestic consumption is the relocation of many of these signals to non-HF modes of transmission. International signals should be readable, however, and with that window on the Pacific you have from up there in the Northwest, you should have pretty good luck. Check any of the books mentioned here over the last few months for some likely frequencies, Richard.

Regards to J.R. Mongrain, of Orange MA who is a TI-99/4A user. I hope that the material presented here a few months back regarding RTTY programs for the TI was of use to use to you, and I am happy to send along the material you requested.

Thanks for the kind words from Pam KB6DKZ in Saratoga CA. I

Crystal FSK Circuit

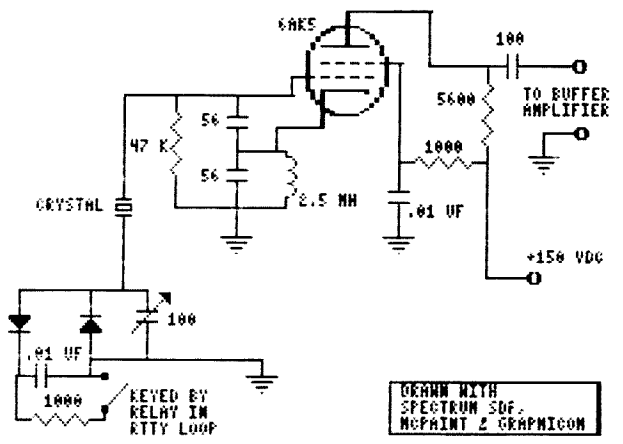


Fig. 1.

glad you find this column as useful as I hope it is, and will continue to try to answer all your questions.

Glenn Farnsworth K2EHM—Howdy Do! As another Apple user, I hope you have not been discouraged in your attempts to get onto RTTY. Again, I hope the material I sent along will provide some aid, and I hope to see you on the air real soon.

Let's see who else I can find in the file. Tom Dillon WJ6M of Los Gatos CA—thanks for the comments and I hope you are doing well on RTTY. Jim Conrad from Odessa TX—my best to you as well. Hope your VIC is RTTYing by this time. If he's not looking, I'll even pass along regards to fellow *73* Associate Editor Bill Gosney KE7C, who has been known to read this column now and then. Bill runs a mean award program, folks. When you finish this issue, why not flip to page 64 of the January, 1986, issue and take a look?

Commodore owners, listen up. I need your help. I have a letter here from Jeff A. Bordeaux which asks some questions I have not seen addressed before, and maybe one of you has the answer. He says that he has been told that, "amateur RTTY communications can be demodulated with a standard Bell type 103 modem used for telephones. Basically, you are supposed to program the RS-232 port on the Commodore-64 for 50-baud operation, five data bits, and modify prescaler values to receive at 45.45, 50, or practically any baud rate. A simple translater program derives ASCII characters off of the five-bit Baudot patterns.

"The method doesn't seem to work for me. Maybe the 200-Hz shift is too narrow for most of the RTTY signals here; maybe the receive frequency tolerance in my 1650 Automodem is too small, etc. I wonder if you may have had contact with someone who has tried this and succeeded.

"In any case, I would like to use a more versatile, but cheap method. I have heard that it is possible to demodulate practically any baud rate, shift, or bit pattern by simply strapping a diode to the Commodore user port and connecting it to the shortwave in some fashion. The method is supposed to use a high amount of software overhead (machine language), but I don't mind."

Well, Jeff, first off, I have problems using a Bell-type modem to receive RTTY, if only because of the tone pairs used. Whereas RTTY uses a 2125-Hz mark and either a 2295 Hz space (for 170-Hz shift) or 2975 Hz space (for 850-Hz shift), I will concede that these frequencies are not sacred, and that by judicious adjusting of the receiver bfo any two frequencies separated by 170 Hz (or 850 Hz) should be obtainable.

Contrast that with the standard tone pairs used on 300-baud modem (Bell type 103) circuits. For the usual operator, operating in the "originate" mode, transmit tones are at 1270-Hz mark and 1070-Hz space; receive tones are 2225-Hz mark and 2025-Hz space. Now, granted that the difference is 200 Hz, "only" 30 Hz away from the 170-Hz RTTY standard, but there is a bigger problem. The mark and space are reversed. This could be corrected

on HF by using the reverse sideband to receive, but transmitting would be a problem, as it would be offset from the receiver by a kHz or so.

Oh, well, I take it that these problems are not insurmountable, as according to your letter someone has done it. I will look forward to hearing from other C-64 owners as to their experiences with this scheme.

Paul Parker KF6OC of Tujunga CA has been trying to get the shift-pot circuit shown here some time back to work on RTTY with an old Globe Chief transmitter. Paul, there is one problem there. The shift-pot circuit is designed to shift a variable-frequency-oscillator circuit, not a crystal, such as you are using in the Globe. My experience, and I used a Globe Chief many years ago, is that shifting a crystal is difficult at best and cannot always be done. If you want to use the shift-pot circuit, you might do well to see if you can't pick up an older outboard vfo for the transmitter. There should be quite a few at the next hamfest you go to, often under $100 (or even less), which will do very well. And going by that old saw, if it's stable enough for SSB, it should be fine for RTTY.

Now, if shifting a crystal is the only way you have to go, you might try the circuit shown in Fig. 1. This vintage circuit will go well with the vintage transmitter you are using and is one way of shifting a crystal. In case you are curious, this circuit is at least twenty-five years old, as you can tell by the specified tube. At any rate, it might serve as a starting point for putting that Globe onto RTTY. Key the circuit through a set of cold contacts activated by your loop, either from the output of the terminal unit or with a reed relay in series with the loop. Layout is important, by the way. Try to keep the crystal and associated wiring as short and point-to-point as possible. Let me know how things go.

By the way, for those who follow such things, the diagram in Fig. 1 was drawn on my little old CoCo, using the Schematic Drafting Processor mentioned here a few months ago, available from Spectrum Projects. The diagram was then cleaned up with McPaint, a public-domain graphics program available in the download menu of the CompuServe CoCoSIG, and lettering put in with Graphicom, by Cheshire Cat, also available from Spectrum. Just shows to go you what a small system can do! Take that, Big Blue.

I have enjoyed chatting with many of you on CompuServe's HamNet. While packet radio is by far the leading topic expressed on the keys, many of you apparently are still interested in more "traditional" RTTY. The only problem is that the loudest group is the vanguard into new areas, while those of you still using Model 15s just go quietly along. Let me hear from all of you, by any means. I have been told that Murray RTTY is dead—do you think that is true? We heard that CW was dead, that AM was dead, that SSB was dead, and so on. It seems to be a popular pastime, declaring this or that phase of the hobby moribund. I don't know, maybe it's my profession, but I am not quite so willing to pull the plug. Are you?

As always, I welcome your comments, questions, barbs, and plaudits. Let me hear from you in the mail to the above address or on CompuServe EasyPlex, HamNet, or CoCoSIG. (Did you ever notice how they like to Double-Capitalize words?) That all important number is 75036,2501. In the mill for coming months will be columns on the Model 33 teletype SREGTR teleprinter, as well as a look at MacPrograms (sorry, couldn't help myself) that are available for MacRTTY (grin). More and more, you just never know what you are likely to find in "RTTY Loop."

Marc I. Leavy, M.D.
Pikesville MD

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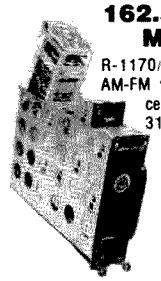
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ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
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The author welcomes inquiries and comments but regrets that he cannot take telephone calls. Please put your inquiries, comments, and submissions in writing. Thank you for your cooperation.

Continuing our discussions from last month on transverters: Several readers have written regarding the low output from the transverter jack on ICOM series radios. Here are simple modifications that will yield about 10–15-dB increase in drive level at 28 MHz on both the ICOM 740- and 745-series radios. You'll need a Phillips screwdriver, soldering iron, wire strippers/cutters, and a short length of RG-174 coaxial cable.

First, remove the top and bottom covers on either radio. Then, locate the six screws that hold the back panel on, remove them, and gently slide the panel away so as not to pull out the nylon multi-pin connectors. Don't pull too hard or you might tear a wire loose from one of those connectors.

IC-740 owners first: On the back panel is a series of RCA-type phono jacks. One jack has nothing connected to it and is labeled SPARE. Locate the connection to the input of the FINAL board. This cable comes from J8 on the RF board and is marked TRF. Desolder this connection from the FINAL board. Now, desolder and tape off the cable to the XVRTR jack as you won't need it. Locate and resolder the cable from J8-TRF to the XVRTR jack, as this will now be your 28-MHz-drive source. Finally, prepare a short 3-inch jumper of RG-174 to be soldered from the SPARE jack to the input to the FINAL board. You'll also need to make up a short 2-inch RCA-male-to-RCA-male jumper with RG-174.

This completes the modification. You no longer need to tie pin 11 of J13 high with +8 volts to enable the transverter jack. However, you must reconfigure the radio for either transverter operation or conventional HF operation, by the way you connect the rear-panel RCA jacks. With a standard transverter, you need to make connections for 28-MHz i-f to the XVRTR and RCVR IN jacks. For regular HF operation, connect XVRTR to SPARE and RCVR IN to RCVR OUT. The bonus is that you will have more than enough drive to make full power with your particular transverter.

IC-745 owners next: Locate the cable from the RF board to the final amplifier. *Caution*: Don't get it confused with the cable from the filter board! Otherwise, you could wind up putting 90 Watts into your transverter input. Locate the rear-panel RCA-jack cluster. Unlike the IC-740, there is no SPARE jack available on the 745 (unless you want to drill a hole and mount one), so you'll have to make a big decision: Do you need the LOW BAND ANT jack? This connection comes into play when the dial is set below 1.5 MHz for a separate longwire antenna or whatever you would use on those frequencies. In the case of the two mods I performed locally, neither ham expressed any interest in this jack. If that is the case for you, then remove the coax from this jack and tape it off.

Next, remove the coax from the XVRTR jack and also tape it off. Locate the output from J10/TRF from the RF board, and reroute it to this jack and solder. Next, make up about 12 inches of RG-174 and run it from LOW BAND ANT jack back to the input of the FINAL board. Inspect your connections and make sure you haven't pulled any nylon connectors loose from the filter board. Replace the back panel and the covers. Finally, make up a short (2-inch) RCA-to-RCA plug jumper for the rear panel. The configuration is the same as for IC-740 users: 28-MHz i-f connections for your transverter go to XVRTR on transmit and RCVR IN on receive. For HF operation, jumper RCVR IN and RCVR OUT together as well as XVRTR and low band ant.

By the way, this modification resulted in 10+ Watts output from a Microwave Modules MMT 144/28 when used with an IC-745. Previous to this, the output was about 1 Watt. So the modification works very well! One additional note: When you make such modifications to your radio you void the warranty. This is standard practice of all ham equipment manufacturers. It's no big deal, really. Just wait until your unit is out of warranty (usually 90 days) if you have any doubts. This modification will not degrade the performance of your IC-740/745 one iota and in fact makes it more useful—at least as far as transverter owners are concerned. Case in point: I use both solid-state and tube-type amplifiers after my transverters. The problem of drive levels arises in that while the solid-state amplifiers need the full 10 Watts or more for full power, the tube amplifiers, which are grid-driven, require much less drive, usually around 2 Watts. Having the transmit and receive lines split at 28 MHz permits the use of a step attenuator to allow either configuration.

My apologies to all who were puzzled by some typos in the December, 1985, column about the AM-6155 amplifiers. First of all, the optional bias circuit came out of left field. Not only did the zener position get reversed, but also the adjustable pot was left out of the circuit and the text specifies the wrong value for the series resistor. Whew! Let's try it again.

Fig. 1 shows the circuit as it should have appeared. This circuit is not new and has been used in many amplifiers. It has even appeared in the *ARRL Handbook*. I have printed it here in case you wish to control the standby and idling-bias current for the 8930 tube used in the AM-6155 in a safe, reliable manner. The suggested mods for AF1T break the screen-voltage line to cut off plate current. Either way will work. Incidentally, the value of the zener is not critical. I've used anywhere from 33 volts up to 56 volts, but it should be about 5 Watts to be safe. The 5000-Ohm, 2-Watt potentiometer is a fairly common item.

If you go for the optional bias circuit, test it by grounding J1 with the plate voltage off and measure the voltage at the grid. It should vary from -130 volts or so down to about -56 volts (minimum resistance of R2). The contacts for closing J1 could be derived from your antenna relay at the back of the amplifier. A DowKey relay would be appropriate here.

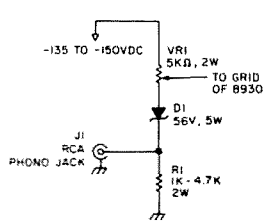


Fig. 1. The optional bias circuit as it should have appeared in December's column on AM-6155 amplifiers.

I should also add that the plate-idling current is adjustable from the top cover and is marked accordingly. If you choose to lift the screen voltage to put the amplifier in standby, then you need only to set this control for the correct idling current, which typically is 90 milliamperes. Some of the stock units come with the idling bias set much higher, but in the original amplifiers 10 Watts of drive provided only 50 to 60 Watts of output—largely due to the input circuit being severely undercoupled to the grid of the 9830 tube. My guess is that the units were set to draw almost 150 mA of idling current, since two that I have seen exhibited this condition before they were modified. However, the listed modifications make the amplifier much more efficient, since much less drive is required to provide equivalent output.

One last correction: The 3.3-pF input capacitor should be shunted with 18–20 pF of capacitance, not the input-tuning capacitor, as the text says. Please follow the schematic for the correct modification. Despite these errors, you'll find the conversion of the AM-6155 to 220 MHz rewarding and the time well spent.

Want to put the unit on 144 MHz? (Boy, have I gotten a lot of inquiries on this one!) Here's the data compiled from Dale AF1T and Woody Peitzer AK2F: First, refer to Fig. 2. Locate C1, the 1.8-pF input-coupling capacitor. This needs to be shunted with 7–20 pF of capacitance. You'll have to experiment with the value. Use silver mica 250-volt capacitors where possible, not disc ceramics. Next, locate C2, the 30-pF input-tuning capacitor. This needs to be shunted with 20–30 pF of capacitance. Again, you'll have to try different values. Finally, C3, the 3.3-pF capacitor to the grid of the 8930, needs to be shunted with about 100 pF of capacitance. This value appears to be constant from amplifier to amplifier.

The last thing you'll need to do is locate the plunger assembly marked VHF-UHF. The AM-6155 comes set up for UHF operation, so follow the arrow direction and change the cavity plunger accordingly. This shaft has a slide lock on

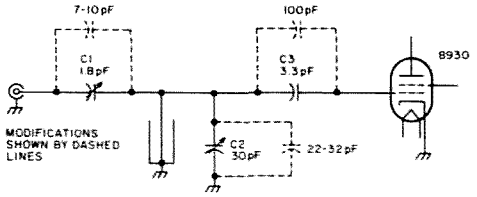


Fig. 2. Modifications necessary for putting 144 MHz on your AM-6155 amplifier.

it to prevent accidental movement. Changing the plunger changes the resonance of the cavity and puts it in the 120–160-MHz range, and setting the turns counter on the output tuning to about 050 to 070 may get you in the ball park quickly when initially tuning up.

One technique that I used when tuning up an AM-6155 for the first time was to bring up the filament and grid voltages, but no plate or screen. Next, I applied a driving source to the input of about 1 Watt and connected a sensitive rf millivoltmeter to the rf output jack. Using this combination, I was able to tune the amplifier for maximum output quite readily. After disconnecting the rf millivoltmeter and connecting a dummy load, it was a simple matter to peak the four controls quickly for maximum output. It also saved a sprained wrist from having to dial away at the slow-turning counter.

Update: Now that I've given the data for the AM-6155 conversion, Fair Radio has gone and sold out all the units they had. Welll Guess I'll just have to mention that they *do* have about a hundred of the AM-6154 VHF cavity amplifier assemblies in stock for about another 50 dollars. These are already tuned for 120–160 MHz but still need additional mods to the Input circuit to increase the coupling at 144 MHz. The critical component there would be C3, and this probably needs to be brought up to about 100-pF capacitance as is the case with the AM-6155 model. I'd appreciate any correspondence from readers (no phone calls, please) who've successfully put these on two meters.

It goes without saying, I guess, that the AM-6154 can be converted up to 200 MHz. You'll need to set the plunger assembly to the UHF position, as indicated by the arrows on the cavity shell. The next step would be to modify the input circuit as per the December article. Again, conversion data from those who've pulled a 6154 up to 220 MHz would be greatly appreciated, and I'll publish it here as soon as I receive same.

One last note regarding Fair Radio: In the recent fall/winter supplement is the #A5–TUN–CAV, which is nothing more than a tunable VHF/UHF cavity using a 4CX250B and 6818 driver tube. No power supply is included. Originally part of an FAA TV-36/TU-9, 50-Watt-transmitter assembly (shades of the AM-6155), the unit comes complete with tubes for about $95. The cavity is silver plated with three tuning controls, including one with a turns counter in it like the 6155.

If you're handy, you can build a power supply for this unit and will need to supply the following voltages: +2000 V dc, +300 V dc, 6.0 volts ac for the filaments, and -135 volts adjustable for the bias. You won't need to use the 6818 tube, but the input circuit is probably undercoupled as in the AM-6155 and 6154. Some modification of the input circuit should result in an amplifier capable of 300–400 Watts output with 3–4-Watts drive In Class AB_1. The bias circuit in Fig. 1 could be used here. The nice thing about this amplifier is that 4CX250Bs are relatively cheap and plentiful at hamfests. I recently bought two that looked brand-new (and worked that way) for a total of $10.

Again, any conversion data is solicited from readers. I might even order one of these myself and fool around with it. The UHF capability suggests possible use on 220 MHz as well. As you can see, there's a lot of surplus out there that can be put to use right away by the VHF enthusiast. Incidentally, I published the address before, but I'll do it again for Fair Radio: 1016 E. Eureka Street, PO Box 1105, Lima OH 45802.

An interesting publication has crossed my desk. It's *VHF Communications*, which is published four times a year in Germany and contains many useful articles, some of which pertain to construction projects. The late Terry Bittan G3JVQ/DJ0BQ was its publisher until his death in early 1985; I'm not sure who is putting the magazine out at this time. This particular issue featured articles on building your own MeteoSat converter for receiving weather pictures from space, as well as a fast-scan TV converter to display them. Also mentioned were projects for a 2–200-MHz wattmeter, compact BNC attenuators using chip resistors, and a 2.3-GHz prescaler for frequency counters.

Most of these articles referenced a listing at the back of the magazine for parts and assembled units. Several of the kits are offered directly through *VHF Communications* by mail order. The articles are well-written and the layout features clean schematics, as well as parts overlays and PC-board templates. The only catch is that many of the parts used are European in origin and finding them here is a bit of a bother. Regardless, the magazine makes for interesting reading. *VHF Communications* is available in the US from U.V. Comms, PO Box 432, Lanham MD 20706. I didn't find a subscription rate but it would appear to be around $17 per year based on the DM-to-dollar conversion.

By the time you read this, the ARRL VHF Sweepstakes will have come and gone, but I hope that many of you took a little time and got on the air to make a few QSOs. This is by far the largest VHF contest (well, what else is there to do in January?) and draws several hundred entries. One good thing about contests is that they lead to increased activity on many quiet bands, such as 220 and 1296 MHz. It's also a great time to make a performance check of your station equipment. I've aligned many a preamplifier, converter, and transverter during a contest (sometimes when I didn't plan on it). There sure are a lot of weak signals to choose from.

Missed the VHF SS? There's the ARRL Spring Sprints which start in April. These basically are a series of monoband one-night contests with 4-hour periods, hence the name "sprint." Details are available in *QST*. Again, these are fun ways to spend an evening, really finding out just how much activity is around on your favorite band.

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Not much further down the road lies the ARRL June VHF QSO Party, the first of the big four summer contests. This is the second most popular VHF contest with many stations traipsing around to various hilltops and grid squares to give out points.

Close on its heels is the *CQ* Worldwide VHF WPX contest in July. The WPX ran for the first time last July and received an astounding 460+ entries from all over the globe. This is the only contest that uses prefixes (WB2, DL0, JH1, G3, VE4, etc.) for multipliers and has met with very enthusiastic response. I am co-chairman of the *CQ* VHF WPX Contest Committee with Steve Katz WB2IK of *CQ* magazine and will mention from time to time some of the more interesting scores and stories from this event.

Bringing up the rear are the ARRL UHF Contest in August and the ARRL September VHF QSO Party. The latter is often noted for its wild tropo openings, such as in 1984 when the Massachusetts-to-Georgia path was worked on 1296 MHz! So, you can see that there are plenty of opportunities to "exercise" your station and have fun doing it as well.

Although VHF and UHF contesters are every bit as serious as HF contesters (maybe even more), the bands are never as hectic and with Sporadic-E, Aurora, Meteor Scatter, and Tropo Scatter awaiting you there are plenty of surprises. Just wait until about five years from now when the sunspot cycle is on the way up and you start hearing G3s coming through your speaker! (Not to mention LU, YV, XE, VP, and possibly DL/F/EA and other Europeans as well.)

This might be a good time to shop around for a used 50-MHz rig, such as the ICOM IC-551 and 551D series. Many of these are showing up at flea markets since their owners have lost interest with the declining sunspot cycle. For those who don't know, the IC-551 is a 10-Watt multimode with built-in power supply, while the 551D runs 80-Watts output and requires a separate supply. Unlike most multimode radios, they were designed for SSB/CW operation, with FM an add-on. The receiver performance is most satisfactory, although it can be improved considerably with a good MOSFET preamplifier.

Update #2: Late word from Ivars Lauzums KC2PX brings the news that hams in Great Britain have been granted 50-MHz privileges—the first step, hopefully, to wide-scale 6-meter operation on the European continent.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards or odd-sized scraps of paper. Please type or print your request (neatly!, double-spaced, on an 8-1/2 x 11 sheet of paper and use upper- and lower-case letters where appropriate). Also, please make a 1 look like a 1 not an l—which could be an el or an eye, and so on. Hard as it may be to believe, we are not familiar with every piece of equipment ever manufactured on Earth! Thanks for your cooperation.

I am looking tor a manual for a National NC-183D general-coverage shortwave receiver.

Several years ago I was referred to a place in Missouri which carried manuals and schematics for older equipment. Does anyone have the name and address of this or of any place that would have them?

Lawrence W. Joy NO0S
586 Fremont Drive
Littleton CO 80120

I would like to locate a Johnson model #122 vfo and a Johnson #6N2 vfo.

Joseph Karr N9FAU
3800 Cheyenne Avenue
Racine WI 53404

If anyone has a copy (in good condition) of the book, *The Complete Handbook of Slow-Scan TV*, by Dave Ingram K4TWJ (Tab Book No. 859) and wants to sell it, please write and tell me your price. I will pay in advance.

Carlos Urbina Pacheco
Calle 14 No. 1128 Norte
Torreon, Coahuila 27000
Mexico

I need the manual or schematic and alignment procedures for a John Fluke differential voltmeter, model 803D/AG. I will pay postage and copying costs. Please write before sending any material.

Robert P. Whitted DA2EB
PO Box 2567
APO NY 09123

A ham radio/computer club wishes someone to donate a working or non-working disk drive for use in the club. The drive needed is for either a Radio Shack TRS-80-II color computer or an Atari 800XL computer.

Howard S. Bacon
213 Holly Avenue
So. Pittsburg TN 37380

I want to start a newsletter on slow-scan TV/radio facsimile/satellite weather photos. Anyone who might wish to write for it should write to me.

Howard S. Bacon
213 Holly Avenue
So. Pittsburg TN 37380

I am looking for support brackets for the AN/URA-17 comparator-converter unit.

Charles T. Huth
229 Melmore Street
Tiffin OH 44883

I need the instructions and schematics for the Macrotronics Terminall RTTY program. I presently have version 2.0 manufactured in 1982. I am also interested in any and all software for RTTY for the Model IV TRS-80 computer.

Dennis D. Watters WB0TAX
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APO New York 09701

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HP 626A SIGNAL GENERATOR, 10 GHZ TO 15 GHZ INTERNAL, EXTERNAL, PULSE, SQUARE WAVE, FM MODULATION CALIBRATED OUTPUT, 10 MW TO 1 PW $650.00
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MARCONI TF 1066B SIGNAL GENERATOR 10 MHZ TO 470 MHZ, AM/FM, CALIBRATED OUTPUT, INTERNAL FM OF 1 AND 5 KHZ WITH 100 KHZ VARIABLE DEVIATION, AM MODULATION OF 1 AND 5 KHZ, CALIBRATED RF OUTPUT 0 TO 200 MV $550.00
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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough, NH 03458-1194.

FORT MYERS FL
MAR 1

The Fort Myers Amateur Radio Club is sponsoring the City of Palms Annual Hamfest, March 1, at the Moose Lodge Hall, 1900 Park Meadow Dr., ½ block off U.S. 41, South Fort Myers. Admission is a $3 donation. Talk-in on 2 meters, 146.28/.88. There will be exhibitors, dealers, and forums on antennas, packet radios, DX. Swap tables are $10.

CHICOPEE MA
MAR 2

The Mount Tom Amateur Repeater Association will hold its annual flea market on March 2, 1986, from 8:00 am to 3:00 pm, at the Knights of Columbus Elder Council 69, Granby Road, Chicopee MA. Admission is $1.00; ladies and children under 12 are free. Tables are $7.00 in advance and $8.00 at the door. For more information, contact MTARA, PO Box 3494, Springfield MA 01101.

WINCHESTER IN
MAR 2

The Randolph Amateur Radio Association will sponsor a hamfest on Sunday, March 2, 1986, from 8:00 am to 5:00 pm, at the Winchester National Guard Armory, Winchester IN. Admission is $3.00 (under 12 free). Spaces are $5.00 with a table and $2.50 without (available by reservation only). Talk-in on 147.90/.30 and 224.90/223.30. For reservations or more information, write RARA, PO Box 162, Winchester IN 47394, or call Jake Life W9VJX at (317)-584-9361 or Herb James WB9UZZ at (317)-584-4995.

CIRCLEVILLE OH
MAR 2

The Teays ARC will sponsor a hamfest on Sunday, March 2, 1986, from 8:00 am to 4:00 pm, at the K of C Building, 2489 North Court Street, Circleville OH. Tickets are $3.00 in advance and $4.00 at the door. Tables are $5.00 in advance and $6.00 at the door. For tickets (send an SASE) or more information, contact Dan Grant W8UCF, 22150 Smith Hulse Road, Circleville OH 43113; (614)-477-3026.

ARMADILLO COUNTY TX
MAR 2–OEC 31

To commemorate Texas' sesquicentennial year, Armadillo County has been created by Governor Mark White. Any ham operating from those highways marked "The Texas Independence Trail" may sign Armadillo County, Texas. The Texas DX Society is planning to operate special-event station K5DX/A on March 2, 1986. Armadillo County has been sanctioned by the USACA. For further information, call Tom Taormina K5RC at (713)-489-1152 or write the Texas DX Society, PO Box 540291, Houston TX 77254-0291.

DALTON GA
MAR 8

The Dalton ARC will hold its annual hamfest on March 8, 1986, at the North Georgia Fairgrounds, Dalton GA. Further information may be obtained from the local HF and VHF nets or by writing the Dalton ARC, PO Box 143, Dalton GA 30722-0143.

MILWAUKEE WI
MAR 8

The Milwaukee School of Engineering ARC (W9HHX) will sponsor its annual hamfest on Saturday, March 8, 1986, from 8:00 am to 2:00 pm, at 1121 North Milwaukee Street, Milwaukee WI. Tickets are $2.00 and 4-foot tables are $3.00. Talk-in on 146.19/.79 and 146.52. For more information, send an SASE to W9HHX Fest, PO Box 644, Room C-6, Milwaukee WI 53201-0644.

STERLING IL
MAR 9

The Sterling-Rock Falls Amateur Radio Society's 26th Annual Hamfest will be held March 9 at the Sterling High School Fieldhouse, 1608 4th Ave., Sterling IL. Doors open at 7:30 am. Tickets are $3 in advance, $4 at the door. Tables requiring electricity and commercial tables are $5; all others $3. Talk-in on 146.25/.85. There will be free parking, and space to accommodate campers. For tickets, tables, or more information, write Sue Peters KA9GNR, PO Box 521, Sterling IL 61081, or call (815)-625-9262.

INDIANAPOLIS IN
MAR 9

The Indiana Hamfest, sponsored by the Morgan County Amateur Radio Association, will be held on March 9, at the Indiana State Fairgrounds Pavilion Building in Indianapolis, Indiana. Admission: $5.00 at the door. Fleamarket table: $8.00; space without table: $3.00. All tables must be reserved in advance. Setup will be Sunday, March 9, 6–8 am. No cars inside after 8 am, Sunday. Free paved parking. Talk-in on 145.25. For more information, send an SASE before March 1 to Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47401, (812)-339-4446.

WHIPPANY NJ
MAR 14

The Splitrock Amateur Radio Association presents its first annual Evening Hamfest on March 14, beginning at 7 pm at the VFW Post 3401, Tabor Road (Rte. 53) in Morris Plains NJ. Admission is $1; sellers' tables $7. For additional information write PO Box 3, Whippany NJ 07981 or K2RF Repeater: 146.385/146.985.

HUDSON NH
MAR 15

The annual Interstate Repeater Society Flea Market will be held March 15 at the Hudson Lions Club, Lions Avenue, Hudson NH from 9 am to 4 pm. Doors will open at 8 am. Admission is $1 and tables are $8. Talk-in on .25/.85 and .52. For further information or advance table reservations, contact Richard Everhart WB8YGR, 25 Briand Dr., Nashua NH 03063, or call (603)-889-3479.

AUBURN NY
MAR 15

The Auburn ARA will hold its annual Winterfest on March 15, 1986, from 9:00 am to 5:00 pm, at the Farm/Home 4H Center, Grant Ave./Route 5, Auburn NY. Admission is $3.00; tables are $5.00. Testing will be available. Talk-In on 147.00. For more information, contact Robert C. Bruno WA2ITJ, 1 Birch Lane, Auburn NY 13021.

MIDLAND TX
MAR 15–16

The Midland ARC will hold its annual St. Patrick's Swapfest on March 15–16, 1986, from 10:00 am to 5:00 pm on Saturday and from 8:00 am to 2:30 pm on Sunday, at the Midland County Exhibit Building, east of Midland TX on the north side of Highway 80. Admission is $5.00 in advance, $6.00 at the door. For more information, contact the Midland ARC, PO Box 4401, Midland TX 79704.

JEFFERSON WI
MAR 16

The Tri-County ARC (W9MBQ) will hold its annual hamfest on Sunday, March 16, 1986, from 8:00 am to 3:00 pm, at the Jefferson County Fairgrounds, Jefferson WI. Tickets are $2.50 in advance and $3.00 at the door. Tables are $3.00 in advance and $4.00 at the door. Exams will be given. Talk-in on 144.89/145.49 and 146.52. For tickets or more information, send an SASE to Bob Barker K9RIJ, 724 Burdick, Milton WI 53563.

VALHALLA NY
MAR 16

The Westchester Emergency Communications Association will hold its second annual hamfest and electronics fair, WECAFEST 86, on Sunday, March 16, 1986, in the cafeteria of the Westchester Community College Student Center, Valhalla NY. Admission is $2.00 (under 16 free). Exams will be given. For more information, write WECAFEST 86, PO Box 348, Millwood NY 10546.

MAUMEE OH
MAR 16

The Toledo Mobile Radio Association, Inc., presents its 31st annual Ham Fest and Computer Show to be held on Sunday, March 16, 1986, at the Lucas County Recreation Center on Key St., Maumee OH. Hours will be from 8 am to 5 pm. Free parking. Tickets are $2.50 in advance; $3.00 at the door. Tables will be available and displays are limited to electronic, amateur, and computer equipment. FCC examinations: Technician through Extra by appointment only. To apply, send a completed form 610, a copy of your present license, a check for $4.25 made out to the ARRL/VEC, and an SASE to Elmer Zieroff KU8B, 2614 106th Street, Toledo OH 43611. Cutoff

date for applications is February 16. Women's activities begin at 11 am. Talk-in frequencies: 147.87/.27. The TMRA repeaters are on 147.87/.27, 447.850/442.850, and 224.140/222.540. There will be refreshments. For further information, contact Joseph Nyitray W8LNV, 3950 Drummond Road, Toledo OH 43613, (419)-472-7935.

CHELSEA MA
MAR 18

Chelsea Civil Defense will sponsor amateur-radio evening classes at Chelsea High School starting March 18 for those interested in obtaining a Novice or basic level ham license, or Technician/General license. A minimal cost will be charged for material only. The classes will be open to all in the local area who have an interest in becoming a ham. For more information write: Frank Masucci, 136 Grove St., Chelsea MA 02150. Include your phone #.

BLACKSBURG VA
MAR 19–21

A workshop entitled Personal Computer Interfacing for Scientific Automation will be held on March 19–21, 1986, in Blacksburg VA. The cost is $495. For more information, contact Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg VA 24061; (703)-961-4848.

SEATTLE WA
MAR 20

Volunteers from several local ARCs will operate KD7WS from the 9th annual Northwest Science Fiction Convention (NORWESCON) in Seattle from 1800Z to 0200Z for four days starting March 20. Demonstrations and speakers to introduce young people to ham radio are also planned. Frequencies: phone—bottom 25 kHz of General phone bands; CW—bottom 30 kHz of General CW and Novice bands; RTTY—7.085, 14.090, 21.090; VHF via 146.96 repeater. Certificate for QSL and SASE via John V. Hedtke KD7WS, 8729 Palatine N., Seattle WA 98103.

MARSHALL MI
MAR 22

The Southern Michigan ARS and the Marshall High Photo-Electronics Club will sponsor the Michigan Crossroads Hamfest on Saturday, March 22, 1986, from 8:00 am to 3:00 pm, at Marshall High School, Marshall MI. Admission is $1.50 in advance and $2.00 at the door. Tables are $.50/ft. Exams will be given. Talk-in on 146.52 and 146.07/.67. For more information or reservations, write SMARS, PO Box 934, Battle Creek MI 49016, or call Wes Chaney N8BDM at (616)-979-3433.

UPPER SADDLE RIVER NJ
MAR 22

The Chestnut Ridge Radio Club will hold the 9th annual Ham Radio Flea Market on Saturday, March 22, 1986, at the education building of the Saddle River Reformed Church, East Saddle River Road and Weiss Road, Upper Saddle River NJ. Tables are $10.00 for the first, $5.00 each additional table. Tailgating: $5.00. Refreshments. For further information, contact Jack Meagher W2EHD, 27 Fourth St., Closter NJ 07624, (201)-768-8360.

MACON GA
MAR 22

The Macon County Amateur Radio Club W4BKM will operate a special-event station live from the Cherry Blossom Festival in Macon GA, March 22, 1986, from 10 am to 5 pm EST. Frequencies will be phone, 14.237 and CW, 7.137. For a Cherry Blossom Certificate, please send a large SASE to Mona Witherington N4MPR, 2898 Williamson Drive, Lizella GA 31052.

ELIZABETHTOWN KY
MAR 22

The Lincoln Trail Amateur Radio Club will sponsor the 1986 Elizabethtown Hamfest on March 22, 1986, at the Prichard Community Center in Elizabethtown KY. Talk-in on 146.38/.98. For more information, contact Hubert Hensley WD4GDA, PO Box 387, Vine Grove KY 40175, or call (502)-877-2234.

HERMITAGE PA
MAR 22

The Mercer County Amateur Radio Club welcomes amateurs to socialize and exchange views at its "How To" seminar on March 22 from 9 am to 4:30 pm at the Hermitage Middle School, opposite Shenango Valley Mall on Rt. 18 in Hermitage PA. Topics will be presented on development of ham-shack skills. License examinations (Novice through Extra class) will be given. Examinees and those under 18 will be admitted free; all others $2. Talk-in on 147.75/.15. SASE to MCARC, Box 996, Sharon PA 16146 for details.

EGG HARBOR CITY NJ
MAR 22

Shore Points ARC invites everyone to Springfest '86, Saturday, March 22, from 9 am to 2 pm at the Atlantic County 4-H Center, Egg Harbor City NJ (15 miles west of Atlantic City).Limited ac in indoor space. Sellers $5 per space (bring your own table); buyers $2.50 advance, $3 day of hamfest. Talk-in on 146.985 and .52. For more information, write: SPARC, PO Box 142, Absecon NJ 08201.

COLUMBUS GA
MAR 22–23

The Columbus GA ARC will sponsor a Hamfest Saturday on March 22 from 9 am to 5 pm and Sunday from 9 am to 3:30 pm at the Columbus Municipal Auditorium. Indoor tables are $6.50 per day. Contact Joe Mills at (404)-687-3050 or write CARC, PO Box 6336, Columbus GA 31906 for table rentals. FCC exams will be given Saturday at 9 am at the Colonial Inn. Talk-in is on 146.01/.61. For more information call Billy Bedgood at (404)-323-5579 or Bill Haycock at (404)-327-7345, or write CARC.

MADISON OH
MAR 23

The Lake County ARA will sponsor the eighth annual Lake County Hamfest/Computerfest on March 23, 1986, beginning at 8:00 am, at Madison High School, Burns Road at Middle Ridge Road, Madison OH. Admission is $3.00 in advance and $4.00 at the door. 6-foot tables are $5.00; 8-foot tables are $6.50. Exams will be given. Talk-in on 147.81/.21. For more information, send an SASE to LCARA Hamfest, 5261 Harmony Lane, Willoughby OH 44094, or call (216)-953-9784.

GRAYSLAKE IL
MAR 23

The Libertyville and Mundelein ARS will sponsor LAMARSFEST 86 on Sunday March 23, 1986, from 8:00 am to 2:00 pm, at the Lake County Fairgrounds, Grayslake IL. Admission is $2.00 in advance and $3.00 at the door. Tables are $5.00 each. Talk-in on 147.63/.03 and 146.52. For information or reservations, write Marc Abramson, PO Box 633D, Wheeling IL 60090.

TRENTON NJ
MAR 23

The Delaware Valley Radio Association will hold its 14th annual amateur-radio and computer flea market on Sunday March 23, 1986, from 8:00 am to 2:00 pm, at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, Lawrence Township, Trenton NJ. Admission is $3.00 in advance and $4.00 at the door. Flea-market spaces are $5.00 ($7.00 for wall spaces). Sellers must provide tables. Talk-in on 146.07/.67. For advance registration or more information, send an SASE to KB2ZY, Box 441B, RD #1, Stockton NJ 08559.

TIMONIUM MD
APR 6

The Baltimore Amateur Radio Club will present the 1986 Greater Baltimore Hamboree and Computerfest on April 6 at the Maryland State Fairgrounds Exhibition Complex at Timonium MD. Gates open at 8 am. The fairgrounds are located east of I-83 exit 17, three miles north of I-695, just north of Baltimore. Admission is $4, children under 12 free. For further information, contact: G B H & C, PO Box 95, Timonium MD 21093-0095, or call (301)-561-1282. For a recorded announcement, dial: (301)-HAM-TALK.

MADISON WI
APR 6

The Madison Area Repeater Association will hold its 14th annual Madison Swapfest on Sunday, April 6, at the Dane County Exposition Center Forum Building in Madison WI. Doors will open at 7:30 am for flea-market sellers and at 8 am for the public. Admission is $2.50 in advance and $3 at the door. Flea-market tables are $5 in advance and $6 at the door. Talk-in will be on the M.A.R.A. repeater, WB9AER/R, 146.16/.76. For more information, write: M.A.R.A., PO Box 3403, Madison WI 53704, or call (608)-222-4744, day or night.

OLD BRIDGE NJ
APR 6

The Old Bridge Amateur Radio Association will hold an indoor/outdoor Electronics Flea Market, April 6, at the Knights of Columbus Hall in Old Bridge. The hall is located on Pine Street off Rt. 18 in Old Bridge. Talk-in frequencies are 147.120+600 and 146.520. Admission will be charged and a door prize will be awarded. Sellers may register by mail. Send SASE for details to Bob Navin, 106

Madison Ave., Old Bridge NJ 08857.

GROSSE POINTE MI
APR 6

The South Eastern Michigan Amateur Radio Association (SEMARA) will hold its 28th annual Hamfest Swap and Shop at the Grosse Pointe North High School, 707 Vernier Road, Grosse Pointe Woods MI, from 8:00 am to 3:00 pm. The Hamfest will feature an ARRL forum, DX forum, and a RTTY forum. Advance tickets $1.00, at the door, $3.00. Advance tables $8.00, at the door, $10.00. Talk-in on 147.75/.15 and 146.52. For more information, write to SEMARA Hamfest, PO Box 646, St. Clair Shores MI 48080, or phone Fred Lewis NK8M at (313)-881-0187.

SULLIVAN IL
APR 20

The Moultrie Amateur Radio Klub (MARK) hamfest, formerly held at Sullivan IL, will be held Sunday, April 20, from 8 am to 3 pm at the Coles County Airport, located between Mattoon and Charles IL on Rt. 16. The hamfest will be in a large, heated hangar. Admission is $2 advance, $3 at door. No extra charge for vendors, but bring tables. Talk-in on 146.655/146.055 or 146.52. Further information, write MARK, PO Box 79, Sullivan IL 61951, or call Vernon Jack K9SWY at (217)-728-7596.

DAYTON OH
APR 25

The Miami Valley FM Association will sponsor the 17th annual B*A*S*H, on Friday night of the Hamvention, April 25, at 7 pm in the Conference Center at the Hara Arena and Exhibition Center, Dayton, Ohio. There is no admission charge.

DAYTON OH
APR 25–27

The Dayton Amateur Radio Association, Inc., will sponsor the Dayton Hamvention on April 25–27, 1986, at the Hara Arena and Exhibition Center, Dayton OH. Admission, valid for all three days, is $8.00 in advance, $10.00 at the door. Banquet tickets: $14.00 in advance, $16.00 at the door *if available.* Ladies luncheon, $6.75. Advance sale deadlines: April 5 (Canada) and April 12 (USA). Roy Neal K6DUE will be the banquet speaker.

Giant Flea Market: noon Friday through Sunday. *All spaces sold out.*

Technical forums on: personal computer, packet radio, ARRL, AMSAT, antennas, RTTY, SSTV/ATV, FCC, electrical safety, and other topics. CW Awards—try to break the 72.5-wpm world record!

License exams: Novice through Extra, by reservation only. Send before March 29: completed form 610, a copy of your present license, and check or money order for $4.25 payable to ARRL/VEC, to: License Exam, Attn. Tom Holmes, 8830 Windbluff Pt., Dayton OH 45459.

Send nominations for "Radio Amateur of the Year," "Special Achievement," and/or "Technical Achievement" Awards, to Awards Chairman, Box 44, Dayton OH 45401, before April 1.

For further information, see HAMVENTION ad on page 15.

FITCHBURG MA
APR 26

The Montachusett Amateur Radio Association will hold Flea Market Saturday, April 26 at the Knights of Columbus Hall on Electric Avenue, Fitchburg MA. Doors open at 8 am for sellers and 9:30 am to 3 pm for buyers. Talk-in on 144.85/145.45 and 146.52. Admission is $1; tables $8 each. For table reservations send check payable to M.A.R.A., c/o James Beauregard, 7 Mountain Ave., Fitchburg MA 01420.

CEDARBURG WI
MAY 3

The Ozaukee Radio Club, Inc., will sponsor its 8th annual Cedarburg Swapfest on Saturday, May 3, from 8 am to 1 pm at the Circle B Recreation Center, Highway 60 and County I, in Cedarburg WI (20 miles north of Milwaukee). Admission is $2 in advance, $3 at the door. Four-foot tables are $3 each. Sellers will be admitted at 7 am for setup. For more information, send a business size SASE to 1986 ORC SWAPFEST, 101 E. Clay St., Saukville WI 53080.

GRAND JUNCTION CO
MAY 10

The Grand Mesa Repeater Society will hold the Seventh Annual Western Slope Amateur Radio and Computer Swapfest on Saturday, May 10, 1986, from 9:00 am to 4:00 pm at the National Guard Armory, 482-28 Road, Grand Junction CO. Admission is free and swap tables are $5.00 each. Features will include an indoor swapfest, amateur radio exams, a packet radio demonstration, an auction, and refreshments. Talk-in on 146.82 and 449.20. To reserve a swap table and for further information, send an SASE to Larry S. Brooks WBØECV, 3185 Bunting Ave., Grand Junction CO 81504, or call (303)-434-5603.

HARTWELL GA
MAY 17–18

The Lake Hartwell Hamfest, May 17–18, sponsored by Toccoa (Hartwell GA and Anderson SC) ARC, will be held at the Hartwell Group Camp, Hwy 29, 20 miles west of Anderson SC and 3 miles east of Hartwell GA. Campground opens by 6 pm, May 16. Talk-in on 146.295 + 600, 146.19/.79, 147.93/.33. Free flea market space. Tickets and information available from M. A. Counsell W1BNS, 215 Nottingham Way, Anderson SC 29621; (803)-261-7018.

HBØ DXPEDTION
MAY 22–JUN 2

The Wiesbaden Amateur Radio Club, WiesARC, an ARRL affiliated club from West Germany, will be found on the air again from Liechtenstein during the club's eleventh annual DXpedition from May 22 through June 2, 1986. The club will be operating the HBØ/DA1WA callsign on all bands using both CW and SSB. Each contact with DA1WA counts heavily toward the club's Urkunde (award) Certificate. Urkunde information may be obtained from the QSL managers. US and Canadian stations QSL (with 22-cent SASE) via regular US mail (22 cents) to Steve Hutchins KN6G/DA2HS, Box 4205, APO NY 09633-5374. All others QSL with IRC via Hugo Jakobljevich, Im Weinberg 10, D-6200 Wiesbaden-Auringen, West Germany.

CAMBRIDGE MA
JUN 16–20

The Massachusetts Institute of Technology is again offering a program of applied imaging, "Techniques in High-Speed Photography and Videography." The special summer program will be held from June 16 to 20. This photoinstrumentation program of complimentary lectures and laboratory experiences is under the direction of C. E. Miller and Dr. Harold E. Edgerton. It includes two full days in the MIT Stroboscopic Light Lab. For further details, contact: Director of the Summer Session, E19-356, Massachusetts Institute of Technology, Cambridge MA 02139.

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LETTERS

AT YOUR SERVICE

In general, I have been very pleased with the improvements in *73 for Radio Amateurs*, and I have continued my subscription. The technical content of your articles has improved. QRX is a good section. I like the format and the covers. The breadth of the material is excellent, from editorials to advertising.

However, you seem to have forgotten that the average age of amateur radio operators is about 46 years. Why have you forced those of us who wear bifocals to get out the magnifying glass?

I am not a printing expert; I don't know how many "points" the type is, but it is too small for lots of us out there.

Keep up the good work with *73*!

Staff Stafford NJ8F
Delaware OH

Don't anybody, *not ever*, *oops—Don't* anybody, *not ever, say that this magazine is not responsive to its readers*—KA1MPM.

MONEY OR LICENSE

I am pleased to have this opportunity to respond to Perry Donham's "What?" editorial in your January issue.

I am among those who agree with Perry's hard-line stand on the issue of ham-band commercialism. The editorial correctly made this point: Most of us do not intentionally use the ham bands for commercial gain.

Last week I heard a K1 refuse to accept a formal piece of traffic on one of the local nets because it had a commercial nature. The W2 holding the message commented, "I thought that it would be OK, since it made it this far." Wrong.

It's your license, your station, your decision.

Donham's self-imposed standard is simple and safe. That is, ask yourself whether "the action could eventually result in money exchanging hands."

I keep a dime tucked away inside my wallet next to my ham license. That reminds me that sometimes I need to decide which one to use.

Regards, and 73,

Dave Bushong KZ1O
Nashua NH

ONE MORE CHOICE

I have come up with what I believe to be a more fair and equitable system for licensing amateurs. It may sound like a rehashing of the no-code license, but there is an important difference.

In my system, there would be a basic amateur license with either no operating privileges or just 50 kHz on the 50- and/or 220 MHz bands with full code and phone privileges. This would give the newcomer a taste of what can be done as an amateur. Then higher licenses would be by endorsements by passing the appropriate examination elements.

For example, passage of exam elements 1A, 1B, and 1C would give only code privileges on the respective Novice, General and Advanced code subbands. Passage of exam elements 3, 4A, and 4B would give phone privileges on the respective Technician, General and Advanced phone bands. The requirements for the basic amateur license would be element 2 and a 100% reproduction of the Morse code, matching the representations with the appropriate character. (Most amateurs who operate only phone cannot copy the code at their license level anyway.)

This way, they would at least know it. And this would allow people who cannot copy code due to some handicap, the chance for a license. Then, to keep the Extra bands sacred, you would have to have endorsements for both 4B and 1C to have privileges there.

I hope that you will publish this so that the amateur community will have one more alternative to choose from.

Steve Sulze WD0GIY
Crestwood MO

HELP HOBBY GROW

I've been reading some negative comments about the proposals before the FCC to enhance Novice privileges. Both the ARRL's RM-5038 and my own RM-5022 through RM-5025 request small band segments, restricted power, and the inclusion of digital modes. We never intended to "give the store away," nor do we expect the FCC to grant all the privileges we requested. Our common interest is the growth of our hobby in a responsible way.

I fail to see what you opposers fear. There will be no loss of "higher class" privileges. Who protested the access we gained to 30 meters, or 12 meters, or 902 MHz? The Novice operators have gained nothing. The Technicians gained a band but it is not really an incentive to Novices to upgrade. The big incentive to Novices seems to be 2-meter FM, and that is why my proposal did not include that band.

The ARRL's proposal includes more kHz than mine and is less practical with its inclusion of the 1246-MHz band. I have seen my proposal mentioned in only one publication (*Worldradio*, September, 1985) and have received no comments. My aim is to offer nonhams a Novice license that will attract intelligent adults and young people. We need computer enthusiasts, story tellers, teachers, students, accountants, laborers, etc. Our record shows that we cannot lure them in any numbers with our CW-only Novice license.

Teach a Novice or an upgrade course like I do and you will see the work that goes into each new ham. You old-timers may forget that ham radio and electronics are a new language to the non-ham. We can help squash the myth that equipment is too expensive if we offer new hams phone and digital modes as well as CW. The equipment will be of more use and will seem a better value. Besides, Novices really do *earn* a license.

If, after reading this, you still think enhanced Novice privileges are a bad idea, go read the actual proposals and then comment to the FCC.

Larry W. Garens WD5H
(ex-KC5OQ)
Brady TX

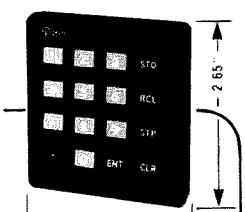
MACHT NICHTS NOW!

I recently encountered a problem which I feel should be brought to the attention of the amateur group for others contemplating a visit, or residence in Italy.

We moved to Italy from Niagara Falls in December of 1984. In January of 1985, I submitted the necessary paperwork for an Italian license.

Sometime later, I received a

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temporary license and more paperwork, along with a request for two "certified photos" plus twenty US dollars, cash only. Again, much later, I received the photos *back* because they were written on.

"How else can you certify them?" asked the US certifying official?

Straightened *that* out supposedly, and *later* received another temporary license application.

Here it is, December of 1985, and two weeks ago received another very official-looking piece of paper that turns out to be *another* temporary permit along with a letter to the effect, "congratulations, *now* you can begin the application process for obtaining a permanent Italian license!"

Macht nichts now! We moved back to Germany where, thank goodness, the amateur licensing system is *much* more efficient—it took me about 30 minutes to get my license versus the eleven-months-and-still-in-process in Italy. I think that after they received the US *cash*, that was the prime concern. You were then relegated to the Italian paper mill.

I would strongly advise any potential radio-amateur visitors to Italy to thoroughly investigate the procedures before attempting reciprocal licensing! To me it was very disappointing.

Jerry S. Richter KI1WY/DA2RI
Munich, West Germany

WEIRDNESS REVISITED

Great editorial in the January issue! May I add some thoughts of my own?

I guess this could be construed as picking on the simplex autopatch boys (again), but I wonder—just wonder, mind you—about the propriety of the brethren setting up a simpatch system and then charging individual members of the group for the privilege of using it.

You see, if I pay dues to a repeater to keep it up, I am buying the right to keep the system going, and that includes the right to use the repeater, plus its autopatch, its electronic bulletin board, or its remote bases—or all of the above.

The problem with a paid simpatch group is that all you are paying for is the simpatch function, which smacks a lot of competition with the local cellular system—especially if it is abused, which I still think it is in all too many instances. Maybe I'm wrong. Maybe a simpatch can offer other things as well, but I haven't seen that sort of thing actually put into practice.

Now, mind you, I have no serious problem with *repeater* autopatches. I've turned in a couple of DWIs using ours, in the last year, and that is enough to convince me that autopatches are in the public interest, when all is said and done. I just believe that the rise of simpatches may be the beginning of the end for amateur interconnects to the telephone system in any form. And that's not just me talking.

Re the QRX item "Weirdness," we have some retractions to make. Suffice it to say that the intent of the CTIA with regard to S-1667/R-3378 has been terribly misrepresented in the amateur media, much to our embarrassment, I'm afraid. I feel that, as a group, we really blew it with this one, and our credibility has suffered as a result. See the December *'220 NOTES* for details.

That is not to mean that S-1667, *et al*, should be ignored. This is a prime example of a horribly written bill that should be either cleaned up or killed, the question of Right-to-Listen vs. Rights-of-Privacy totally aside. With this question included, I would strongly suggest that a technological solution to the privacy issue is far superior to a political one, and again, I refer you to the December *NOTES*, which should be out in a few days.

Art Reis K9XI
New Lenox IL

DONHAM'S LAW

KW1O's attack on commercialism in the January, 1986 issue of *73* is well stated. There are, in fact, many situations encroaching on the FCC rules on noncommercial use of Amateur Radio.

The problem with Donham's Law is in the "could eventually." How do you allow for the discussion of equipment among hams? Someone will be influenced to go buy something as a result. I say this is too broad in scope.

Then do you say we can't talk about FCC exams under the VEC program since there is a fee charged for registration, and that is certainly "money exchanging hands"?

I think, in general, hams exercise excellent judgment in how they use the air.

Staff Stafford NJ8F
Delaware OH

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73 INTERNATIONAL

Just because I started this column as a result of visiting DX hams is no reason you shouldn't put in your 2¢ worth and let me know what DX news you find most interesting. My inclination is to have DX ops tell us what they think is interesting—how we can get permission to operate if we're fortunate enough to visit—any coming DXpeditions—what's doing with repeaters—things like that. What do YOU find most interesting? Since we have a world hobby, I think you'll be as interested as I in what is going on. If nothing else, it gives us something to talk about on the air which, from what I'm hearing these days, can't hurt.

—Wayne.



AUSTRALIA

Jim Joyce VK3YJ
44 Wren
Altona Australia

VK5 AMATEURS GO RAIL MOBILE

The idea to work Rail Mobile on the Trans-Australian Railway from Adelaide to Perth developed from a suggestion that two Australian National-employed amateurs, Keith VK5VAX and Graham VK5BGP, undertake the activity in their off-duty period, with the approval of Australian National. The proposal that eventually gained acceptance involved the allocation of two Australian National tickets, the provision of a Wegman 1st class coach for the trip, with media publicity to be sought by Australian National promotions officers, Mr. Bob Sampson and Mr. John Beatty.

The SA Division, through its Jubilee 150 Coordinator, Graham VK5AOZ, was asked to provide equipment and antenna configurations within the parameters of height, location, and installation set by Australian National for the Wegman Coach. The group of three amateurs, Alan Roocroft VK5ZN, Peter Koen VK5BPA, Secretary of 2nd Adelaide Scout ARC, and Graham Horlin-Smith VK5AOZ, were assisted by Keith Pattman VK5NAX, a senior conductor on the outward journey from the Adelaide Terminal departure on Wednesday, September 11, at 12:40 pm.

The turn-around trip left Perth Saturday, September 14, to reach Adelaide on Monday the 16th at 5 pm. Graham VK5BGP joined the group for the return home from Kalgoorlie and also to assist in breaks from his conductor's duties on the train. Five amateurs piloted the rigs during the trip.

Several antennas were installed on Saturday the 7th, including a 25m longwire, a 40m Hustler Whip and a tapped 40m Whip. Two-meter equipment, a Kenwood TR-2500 hand-held with a base supply unit, and a KYOKUTO 144-10FX R2 (FM) with a home-brew scanner, and a 60-Watt amplifier worked from a quarter-wave magna base vertical. A Kenwood TS-93X and a TS-820 provided the fire power for the open wire and the verticals above the carriage roof.

The optimum height of all antennas was fixed at 0.5 meters to allow for clearances of bridges and tunnels, although it was possible to lift the configurations to 1.4 meters between Port Pirie and Kalgoorlie. The problem areas really amounted only to a total distance of 10 km close in to the Keswick and Perth terminals, out of a total journey of 5.320 km. The difficulty in real terms, to make antenna changes, was time and suitable stopovers to periscope the antennas and thereby improve the capabilities of the equipment from the railway mobile location.

The *purpose* of the activity, mutually agreed by the WIA (SA Division) and Australian National, was to give promotion to the two organizations—the Trans-Australian Railway link between Adelaide and Perth, and the hobby of amateur radio. In addition, of a secondary nature, was the promotion of SA and its Jubilee 150 celebrations, including the Grand Prix held in Adelaide in November, 1985. These objectives were as follows:

- To acknowledge Westrails link with Australian National on the WA side of the border,
- To record a first for amateur radio to work Rail Mobile across the Nullarbor, and
- To demonstrate amateur communications as a valuable alternative means of world communications and to provide meaningful goodwill exchanges with people around the world.

The promotional purpose of the five-day round trip was acknowledged by the world of amateur radio by the use of the callsign V15JSA/Rail Mobile (Trans-Australian). V1=special event, WIA (75th Anniversary), oldest AR group in the world, 5=South Australia, JSA=special suffix allocation for *Jubilee South Australia* and Rail Mobile, courtesy of Australian National.

The uniqueness of the special callsign and the location of the amateur-radio stations on the Trans-Australian, it was hoped, would attract special attention to the activity, and it surely did just that!

Amateur displays and public relations were shared jointly by the amateurs making the trip, with overall coordination responsibilities given to Peter Koen, SA's Divisional "Mr. Magic." Armed to the gunwales with posters, awards, QSL cards, banners, flags, and my copies of a home-brew screen print: smcsa amateurs *live* across the nullarborsmc.

The print surpassed any theater coming-attraction poster. Peter's personal professional promotion provided the excellent communications links needed between amateur hobbyists, passengers, visitors, VIPs, Australian National Staff, and flora and fauna of the Nullarbor alike. When out of range of all known two-meter repeaters along the way, Peter did most of the talking to the passengers and captured, on video and camera, a documentary of the lively amateurs' "Pilgrim's Progress."

The identification and project mission of the amateur-radio-coach ADO83 was boldly stated on the platform side of the 25-meter super-sleeper carriage: SA Amateur—World Communications—with Australian National—Across the Nullarbor.

Even the kangaroos, emus, and dingoes, if they could read, and the occasional passerby en route, would have been impressed, if not by the message and callsigns, then by the novel antennas (25-meter longwire and traditional verticals) which graced the roof of the carriage.

The longwire was supported half a meter above the roof by 10 spaced, half-inch, pieces of varnished dowling from a 1-inch piece of water pipe sleeved with dowling at each end of the coach, which were bolted into steel brackets used for flags or external lighting back in the coach's preretirement days. The verticals were bracketed to hand rails on each side of the entrance and exit passenger doors.

The amateurs transformed three adjoining sleeping berths into QTH-like shacks with QSL cards from all over the world, displays of well-earned awards, and even stern reminders of schedules, repeater listings, operating cue cards, amateur photograph displays, and even more stern reminders of footy (Aussi Rules) affiliations.

Card tables supported rigs, working equipment, and logs—nothing new to the familiar sight of a home QTH inside a house, or at a safe distance from the XYL's domain. Comfortable portable beds made working in the horizontal plane with a good view of the landscape outside an excellent prospect. Indeed, it was a worthy scientific experiment to pilot amateur-radio rigs from unusual positions.

What were the results and eventual outcomes?

- A satisfactory number of exchanges—in excess of 500—was made along the way. The bulk were with Australian stations but contacts with the USA, Japan, USSR, NZ, Canary Islands, Indonesia,and South Africa were made.
- Excellent media coverage afforded by television and commercial radio stations.
- Australian National should be well-pleased with the interest sustained by the presence of amateur-radio stations on the Trans-Australian, the goodwill and the exchanges with passengers, also with the overall media presentations in Adelaide and Sydney.
- The use of both VI5JSA and VK75A/Rail Mobile callsigns stimulated the anticipated expected responses.
- Secondary priorities and objectives were successfully achieved by way of the special callsigns with due attention given to SA and its forthcoming activities in 1986.
- The support, back-up, and interest was willingly shared by all Australian national and Westrail per-

sonnel, which made the trip all the more memorable and worthwhile. The travelers were thrilled with the personal attention and the super togetherness engendered.

•Amateur radio gains were significant in terms of promotion and sharing the hobby with the general public, in particular the opportune meeting, and links established with the CARC (Goldfields Amateur Radio Club) and the WIA (WA Division), thus reaffirming the excellent rapport that already exists between amateurs.

•The GARC group of Kalgoorlie presented a framed Gold Award to the travelers, which in turn was presented to SA Divisional President Dick Boxall VK5ARZ—a very beautiful momento of the historic trip. A welcoming "computerized" banner to the SA amateurs at Kalgoorlie was greatly appreciated.

•The well-documented video and camera story of the trip across the Nullarbor, the tapes of the VK6 broadcast, and taped interviews in transit provide a live history for future use.

The overall results of the lighting preparation and culmination (less than three weeks from acceptance to close), were most rewarding. It was a job well done by a very professional group of amateurs led by Bob Allan VK5BJA. The experimentation in rail-mobile antennas and promotional activities carried out by the group was new, save the excellent pioneer work achieved by Bill Main VK6ZX back in the late '70s.



GREAT BRITAIN

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Like many societies concerned with leisure-time activities, the RSGB (Radio Society of Great Britain) is largely under the control of amateurs. There are, of course, full-time paid administrators to run the office and undertake the requirements that the law imposes (the RSGB, at least, is registered as a company).

But the policy-making group, the Society Council, is selected from the membership at large. The Society president is selected by the Council. Over a period of years, one sees the same names appearing as potential or actual council members, committee members, and/or contributors to *Rad Com* (the society's journal, *Radio Communication*), and so on.

Is this a good thing or a bad thing? I think it is certainly true that an element of change, particularly when it involves new blood, is a good thing. People do get set in their ways (and become guilty, perhaps, of being unable to see the woods for the trees), and an influx of new and fresh ideas can only help to bring progress to any organization.

However, that is not to say that wholesale change is good. There needs to be continuity and experience and maturity (and even the steadying hand of elder statesmen). In other words, a balance is wanted between the new and the experienced.

So it has generally been in the RSGB for a great many years. But not for much longer if three members get their way. Messrs. Lundegard G3GJW, Smith G4AJJ, and Crosland G6JNS have ruffled a few feathers with their circulation of documents calling for broad changes in the Society.

I do not wish to bore you with the details (of which there are many) but, instead, will summarize their main point. This seems to be that the length of service of any one individual in a range of posts shall be limited (they suggest six years cumulative service). This, of course, would have the effect of removing all the old hands.

The RSGB has risen to the challenge and produced a lengthy rebuttal of the proposals. I think this is a mistake because the action looks defensive and suggests that there is something for "the few" to protect.

You will note that I have avoided picking sides. I really do not want to be drawn into the argument which inevitably will follow now in the public eye (in the columns of *Rad Com*, if nowhere else). However, I will say that I appreciate the efforts of my fellow amateurs who devote a lot of their time and energy to making my hobby more enjoyable (and that of a lot of other people—at the end of October there were 27,900 Class-A licenses and 27,780 Class-B licenses in force in the UK).

With the imminent availability of the 50-MHz band to all UK amateurs, the RSGB has produced a band plan. This is as follows, and any comments on it should be sent to G3ZNY.

50.000–50.100—CW only
50.02–50.08—Beacons
50.100–50.400—Narrowband modes
50.110—DX Calling
50.200—SSB activity
50.300—CW MS
50.350—SSB MS
50.400–50.500—All Modes

For those of you equipped with a V23 modem (Viewdata type, 75/1200 bps), the RSGB is operating an experimental "Databox." The telephone number from the US is 44 707 52242.



NEW ZEALAND

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New Zealand

As promised in my last column, I am able to bring readers a report on the IARU Region III Conference held in Auckland, New Zealand, Nov. 12-17, 1985, through the courtesy of *Break-In* magazine reporters, Craig Crawford ZL3TLB and Scott Campbell ZL3NR. They made their notes available to me as I was unable to be present at the conference.

It would be difficult to find a more picturesque venue than the Rose Park Hotel in Parnell, Auckland. This modern and spacious hotel is directly opposite the famous Parnell Rose Gardens, where the roses were just coming up to full bloom. From Saturday the 9th there was a scene of frenzied activity as the administration team, ably led by Arthur ZL1HV, worked to prepare everything in time for the opening.

The behind-the-scene administrative workers, led by Neville ZL2AKV, NZART General Secretary, typed, photocopied, and collated the material for the papers to be presented to the Conference (which had escalated from 69 to 85), and inserted them into the well-filled folder for the 70 delegates and observers. Neville was assisted by Shirley ZL1BI, Gail ZL2SZ, and Jamie ZL2NN.

The first batch of overseas delegates arrived at 8 pm on Sunday evening on a flight from Melbourne where they had attended WIA's 75th Anniversary Dinner the previous night. The 29 arrivals were whisked up to the Manukau Room of the International Terminal for a formal welcome.

A surprise for many of them was being presented with an amateur-radio license from within the special callsign group of ZM0ZAA to ZM0ZZZ, plus 100 customized pictorial QSL cards. Some of the visitors made their first QSOs traveling from the airport to the hotel. The ladies accompanying the delegates were not forgotten—they found well-filled satchels in their hotel rooms with information about the Auckland area, conference badges, and general information about the entertainment especially for them during the time their men were in conference.

Some weary, jet-lagged bodies surfaced early morning. Fortunately for most delegates, this was to be a quiet day. For some however, the main business was the continuation of the IARU Administrative Council meeting which had started in Melbourne the previous Friday. This meeting was chaired by Dick W1RU, and attended by K1ZZ, JH1VQR, 9V1RH, VK3KI, W0BWL, and YV5BPG. Ignoring meal breaks, they labored from 9 am until 7:30 pm.

1985
IARU
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REGION 3
CONFERENCE
AUCKLAND • NEW ZEALAND

The ladies, with some of the local people, spent the morning at Kelly Tarlton's excellent Underwater World, a huge aquarium built within Auckland's old sewage tanks. Sharks, sting-rays, octopi, and many species of local fish swam around and over the transparent walk-through tunnel system. In the afternoon they visited the Begonia House of the nearby Winter Gardens.

On Tuesday morning the Region III directors met at Rose Park Hotel. Masayoshi Fujioka JM1UXU, Keigo Komuro JA1KAB, Tsuyako Miyagi, Michael Owen VK3KI, David Rankin 9V1RH, and Arthur Godfrey ZL1HV, debated for much of the day.

Late Tuesday, after airline- and customs-clearance delays, the delegations from Korea, Japan,



Delegates and officials to the 6th IARU Region III Association Conference, Auckland, New Zealand, November, 1985. Photo courtesy of Break In, *NZART official magazine.*

Indonesia, and China arrived. Also on this flight was David Evans G3OUF, general manager of RSGB. The final group of six, including Dick Butler, the secretary general of ITI arrived at 10 pm.

At last, after many hours of preparation, all delegates and observers were present, and the 16,000 pages of documentation were ready for the big event.

The conference got under way at 9:30 am with the official opening. Region III secretary, Masayoshi Fujioka JM1UXU, chaired the opening ceremony and officially welcomed the delegates. Terry Carrell ZL3QL addressed the gathering as president of the host country, and introduced Dame Dath Tizard, the Mayor of Auckland, who, after welcoming them to the city of Auckland, lightheartedly advised that she had arranged excellent weather for the duration of the Conference.

Other speakers were the Honorable Jonathon Hunt, Postmaster-General, and Dick Butler. The Assistant Director General of the New Zealand Post Office, Derek Rose, gave an impromptu speech amplifying the Minister's remarks, and finally Dick Baldwin W1RU spoke thanking the previous speakers for their kind remarks.

After morning tea (coffee break), the first of the 17 90-minute sessions commenced. Present at the sessions were 60 delegates and observers from 11 countries. A very special welcome was made to the delegation from the People's Republic of China, Mr. Wang Xun and Mr. Huang Yongliang, officially attending an amateur-radio conference for the first time.

As is tradition at such conferences, the president of the host society was nominated as conference chairman. This was passed with acclamation, and Terry Carrell ZL3QL took the chair. The Region III Secretary, Masayoshi Fujioka JM1UXU, was nominated as conference secretary, also by acclamation. The Credentials Committee, one of the various committees essential for the smooth running of the conference, reported that all attending Societies were correctly represented, and that proxies for Bangladesh, Hong Kong, Pakistan, Singapore, and the Philippines were in order.

The first of the 93 papers to be received and discussed was the report from Region III secretary, who was happy to announce that the Amateur Radio Club of Tonga, (ARCOT) had just been admitted as the 24th member society of Region III.

Formal reports from the four Region III directors were tabled and accepted with little discussion as lunch was ready.

The various member societies then reported on their activities, and here are some items of interest from the reports. JARL indicated concern at the decline in the rate of increase of membership, down to 10,000 per year. PNGARS (Papua New Guinea) believed they now had the highest amateur repeater in the region, atop Mt. Albert Edward at 3,990 meters above sea level.

ARRL reported on behalf of 37 of the members in Region III territories, noting after a decline in the number of amateurs joining ARRL, they were now experiencing a 5-percent growth. ORARI (Indonesia) announced a new Radio Regs just introduced which included creation of a no-code license. They also hoped to work toward a reciprocal licensing agreement with New Zealand.

WIA (Australia) were happy to report that most of the WIA submissions had been acted upon in the new Regulations and Radio Communications Act which were introduced recently. WIA, representing SARTS (Singapore), mentioned that many apartment dwellers there must pay extra rent for their antennas.

MARTS (Malaysia) entertainingly explained the difficulty they have with authorities. It was reported that the administration's policy seems to have changed from "find out what they are doing and stop them" to "find out where they are going so we can lead them." Until recently, even communications receivers for SWLs were illegal in Malaysia.

RSGB announced only a few days previously that approval had been given for amateurs in Britain to conduct Morse testing as from April, 1986.

KARL (Korea) announced permission had been given for a station to operate from the 1988 Olympic Games to handle third-party traffic for games' participants.

Commenting on the FARA (Fiji) report, ITU Secretary General Dick Butler spoke of his involvement in setting up the Telecommunications Training Center in Fiji and the encouragement it gives students to obtain their amateur license.

Reports from Region I and II were received and Mr. Butler offered ITU's assistance in setting up volunteer training programs in Region I and II countries also. A report from IARU Administrative Council meeting included their adoption of a policy for extensive preparation for future WARCs, including participation in CCIR activities and also a revision of the 28-MHz beacon system.

Ian Ashley ZL1AOX was invited to speak on packet radio and he expressed the opinion that packet radio be band-planned for the phone portion of each band, as is ATV. Dick Baldwin W1RU advised that Region I is uneasy about the proliferation of packet radio on the bands, especially 20 meters.

The conference then considered six papers dealing with band-planning. After some discussion on each paper, Working Group 1 was set up to review the band plans adopted, especially the 28-MHz band, and the position of packet radio and other special modes in any plan.

An NZART paper urged other Societies to negotiate with their administrations for the release of the band 10.15–10.20 MHz on a local non-interference basis. Some delegates were apprehensive about this action, preferring to gain and live with WARC 79 bands first. The NZART proposal was adopted.

Day 2 of the conference opened with discussion on the usage of the new bands made available through WARC 79 (10, 18, and 24 MHz). It was reported that in Region III 10 member societies had access to the 10-MHz band, and seven Societies to both 18 and 24 MHz. The other Societies had access to the 10-MHz band, and seven Societies to both 18 and 24 MHz. The other Societies were encouraged to take appropriate action to acquire usage of these bands and help to populate them.

After a discussion on the involvement of IARU in the forthcoming ITU Conference, preparations for the next WRC (expected in 1991), and the financing of these activities, QSL cards came into the discussion arena.

The Conference accepted a proposal from JARL to adopt the Manila-Conference standard QSL card size and layout, and JARL offered to coordinate an investigation into automatic sorting of cards. Papua New Guinea and Fiji papers on the use of the "honor system" when claiming awards drew much discussion. They argued that QSL cards were a hassle and an expense to rare DX and awards should be claimed by log entry only, as is done in New Zealand. ORARI countered this with the suggestion that QSL cards have many uses, including the promotion of the country and also of Society membership. The PNG/Fiji proposal was lost.

It was noted that with the entry of ARCOT (Tonga), there was only one society in Region III at present that was not a member of the Association.

The report of RAST (Thailand) caused several delegates to express disquiet at the mention of the use of several spot frequencies in the otherwise exclusive 2-meter amateur band for Volunteer Radio, a group of volunteers assisting the police by reporting suspicious happenings. It was felt that this might put ideas into the heads of other administrations along similar lines.

An international model standard, setting down minimum standards for gaining a general amateur license was proposed by NZART and JARL. In many countries that are newcomers to amateur radio, the administrations were often at a loss to set standards and appealed to the amateurs themselves. Therefore the model standard would be a help to these administrations. RSGB expressed the feeling that the proposal should not result in relaxing thestandards. The proposal was adopted.

From this, the concept of a worldwide common amateur license was raised. The effort of the European Societies toward this was noted and encouraged. ORARI commented that while they supported the idea, they could not see it happening in Indonesia in the forseeable future. The formulation of a special study group to investigate legislation that had bearing on amateur radio was suggested and set up, and the proposal passed.

Papua New Guinea's second paper highlighted the abuse of obtaining special prefixes, especially for non-radio events. A proposal to limit the use of special prefixes to national, international, and/or amateur-radio events of outstanding nature was accepted.

Four papers related to the subject of amateur satellites. JARL described progress on JAZ-1, whose launch has now been delayed until August, 1986. The first satellite's construction and testing has been completed and the second is undergoing testing now. The project is expected to cost $US1.6 million. Another JARL paper suggested that IARU coordinate all future satellite programs with ITU and satellite organizations.

The WIA expressed concern over the lack of information on progress of the various projects, on planned launches, and on frequency implications. Working Group 4 was formed to decide any action the Conference needed to take on these matters.

The final subject was the promotion of amateur radio in the developing countries. An NZART suggestion that IARU develop a simple transceiver for the use of these countries was immediately responded to by the Japanese. They showed the Conference a kitset transceiver that produced five Watts output on 15 meters, costing about $US60. NZART commented that, especially in the Pacific Islands, the most desperate need was for training and materials for training, at the very basic level, e.g., tools, books, and expertise. CRSA expressed appreciation for the supportive comments and the reception of their paper by the Conference. Working Group 5 was set up to identify appropriate means to encourage and promote amateur radio in developing countries, and recommend what action should be taken by the Region III Association and its members.

Day three saw the various Working Groups meeting all morning. There was a problem caused by the fact that many members had been nominated for more than one working group, and only three of the six groups had finished by the time Conference recommenced at 1300 hours.

NZART presented the first of four papers dealing with Intruder Watches. They commented on the worldwide nature of the intruder problem and said that a major improvement would be to get all broadcast stations removed from the 40-meter band. Also the Conference was informed that one of the main things to come out of the Geneva Study Group was the confirmation by the International Frequency Registration Board (IFRB) that the IARU Monitoring Service can legitimately call on the IFRB to monitor intruders on our bands.

CSRA noted that Radio Beijing was a major offender in the 40-meter band, and they suffered from this as well. They commented that there were historical reasons among others for this problem and expressed a desire to work towards fixing it. ORARI also reported discussions with their authorities to clear Javanese broadcast stations from 40 meters, and also Indonesian CB interference.

Other items discussed before the Conference adjourned at 1500 to allow the Working Groups to continue their deliberations were that Region III adopt the IARU International Locator System (Maidenhead System) as soon as possible. The Amateur Radio Direction Finding Rules from Region I were considered, and the subject of direction-finding activities in China and Japan described by delegates from those countries.

The IARU Region II Award together with some minor changes to cater for the changes in Region III membership were explained by NZART, and Conference showed its appreciation to NZART for operating the Award for the Association. Emergency communications as outlined in the WARC 79 resolution number 640 were discussed, and the Conference adopted Region I Emergency Procedure "in principle" after some discussion.

At the start of day four, the meeting considered an International Study Group report on the aims and operation of the monitoring service and adopted its recommendations unanimously. A new Region III monitoring service coordinator is required now that Bob Knowles ZL1BAD has been appointed as world coordinator.

Working Group 1 considered band planning, and presented their final report to the Conference. It described band plans for all amateur bands from 7 to 1240 MHz, but due to insufficient information did not consider plans for the 160- and 80-meter bands. Another working group will decide on these before the 1988 Conference. The plan for the 10-meter band included shifting all 28-MHz beacons to the band 28.190–28.200 by 1990. The Group made no special provision for packet radio but recommended that it be allowed in both the phone and RTTY parts of the bands.

Working Group 4 considered the Satellite Service and recommended that all Societies should provide support and funding for all satellite projects; that all frequency-planning matters for satellites be coordinated by IARU, and that the Amateur Satellite Service be represented solely by IARU at ITU Conferences.

Working Group 5—assistance to developing countries—decided the best way to arrange this program would be to ask all Societies what assistance they needed and what type of assistance they could provide.

Six papers relating to the International Beacon Project were considered, and then the Conference decided to adopt the NZART paper which called on the Administrative Council to provide all societies with information on the reporting procedure, to disseminate up-to-date beacon-status information, to review the 28-MHz project, and to provide a beacon kit to developing countries, and coordinate the publicity of the projects.

Contests were next on the agenda, and the Conference considered the adoption of preferred segments of the bands for contest operation as recommended by Region I. It was resolved that a working group consisting of representatives of JARL, WIA, NZART, and ORARI be set up to correspond and recommend on any preferred segments considered desirable.

The Conference proclaimed June 17 to be World QRP Activity Day, to encourage low-power activity—their decision was based on a Region I idea. The Conference also adopted an Administrative Council resolution to establish a World Radio Amateur Day intended to publicize amateur radio universally.

Some aspects of EME operation, packet radio, AMTOR, and RTTY standards, and the growing number of "unattended amateur stations" were then discussed.

A paper on problems resulting from some DXpeditions due to the behavior on air of some of the stations participating was presented, and after much discussion, accepted. ORARI commented that the DXpedition operator was in the best position to deal with this problem, and that IARU was not in any real position to be able to police this sort of thing.

Moving on to the preservations of standards of amateur-radio operation, recommendations by NZART noted the misuse of amateur radio by pirates and others, and emphasized the need to follow the spirit of the ITY Radio Regulations. The President of IARU

commented that, strictly speaking, policing this sort of thing was the responsibility of individual member societies. ORARI replied that they accepted this, but that recommendations by an international body were a very useful lever to help them initiate action in their own country. After considerable rewording to fine tune the meaning, the recommendations were adopted.

Day five commenced far too early for some of the delegates—Saturday night was the social highlight of the Conference, when all delegates relaxed and enjoyed an evening's entertainment, wining and dining, hosted by NZART, when the guests were introduced to some aspects of the Maori culture. The first item was the report of Working Group 2 looking at IARU participation in ITU Conferences. They considered appropriate representation at some designated Conferences, and accepted Councils' goals for the next general WARC. They also recommended continuing participation at CCIR activities, especially Study Group 8.

Working Group 3 presented a 30-page report dealing with changes to the Constitution and By-Laws. In considering this important subject, the meeting studied a large number of changes recommended by the study group. NZART moved the adoption of the proposed changes as recommendations to IARU, and this was passed.

Finances were next for discussion, and as is usual with money matters, there was considerable discussion back and forth, but the recommendations of the Financial Subcommittee were eventually passed almost as presented. NZART proposed the appointment of a regional coordinator for the study of Sporadic-E propagation on six meters, as had been done in Region I, and to recommend that Region II do likewise, to form a worldwide study on the subject. This proposal was adopted unanimously.

NZART presented a paper describing the history of the non-Morse license since its inception in 1963, and the benefits derived from it. It recommended the concept to other Societies as a way to encourage amateur radio. The paper was accepted.

WIA proposed that US be recommended as the preferred mode for sideband operation on all bands. After a lot of fiddling with the wording of the proposal, WIA withdrew it.

There were five nominations for the positions of director for the next three years: Keigo Komuro JA1KAB, Michael Owen VK3KI, D. D. Devan 9M2DD, David Rankin 9V1RH, and Fred Johnson ZL2AMJ. No voting was necessary, and the appointment of David Rankin as Chairman was confirmed.

WIA paid tribute to the work of Arthur Godfrey ZL1HV as a delegate and Director of Region III. In reply, Arthur dwelt on the need for adequate turnover in Association representatives, to get new blood in and avoid inbreeding. Masayoshi Fujioka JM1UXU was elected for a second term as secretary, unopposed. WIA drew the Conference's attention to the extensive backup support for the Secretary provided by JARL, for which the Association is very grateful.

Five invitations to host the next Region III Conference were received from KARL, WIA, PARA, ORARI, and BARL. After a secret vote, it was declared that the invitation from KARL was accepted and that the next Conference would be held in Seoul, Korea, around late October, 1988.

While the delegates were busily engaged at the Conference sessions each day, the ladies who accompanied them were well cared for by the ladies of the host society. Among the activities the ladies visited were tours of an orchard, a potter, a wool shed display, botanical gardens, various scenic drives, shopping trips in Auckland, where the OM's hard earned cash was no doubt well spent on souvenirs, and in the evenings there were receptions hosted by IARU, ARRL, JARL, and NZART.

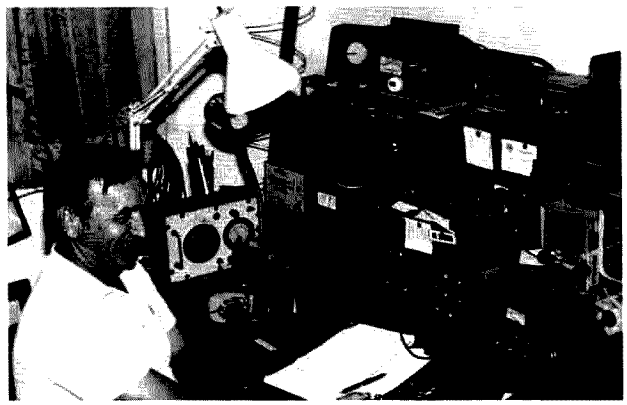
And so ended the 6th Region III Association Conference, after a very busy five days. The delegates bid each other fond farewell and left for their respective destinations, to come together formally in three years time for the 7th Region III Conference.



PHILIPPINES

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Hello, everyone! Now that I have more free time, you probably will see more articles about the state of hamming here in DU-land. I would like to congratulate the officers and members of PARA, the Philippine Amateur Radio Association, for its 52nd anniversary.



Mel Bednar K6LPN/DU2, current trustee of the Central Luzon Amateur Radio Club (CLARC).

Engr. H. San Juan of the National Telecommunications Commission said that his office is set to carry out Memorandum Circular No. 14-11-82—guidelines and procedures of the Revised Amateur Radio Regulations.

Engr. San Juan has said that proper use of callsigns (DU for Class As, DV for Class Bs, and DW for the Class Cs), their proper frequency allocations and, of course, the "jammers," or illegals using the amateur frequencies for their personal use, will be monitored! Under the new Radio Regulations, violation of any of the provisions of the new laws will be punished by a fine of not more than 2,000 pesos (about $100), or by imprisonment of not more than two years for each offense, or both, at the discretion of the court.

If you have followed my other articles in this column you probably have heard me mention CLARC, the Central Luzon Amateur Radio Club which is a unique ham club in DU-land, in that its members consist of local hams and American hams mostly working at Clark Air Force Base in nearby Angeles City, located about 56 miles north of Manila. The base is one of the largest US airbases outside the United States. One of the club's founding members, Pete Bargas DU1AK, is the only American ham who is legally authorized to use a DU callsign. Pete is one of the OT hams in the country; his hamming in DU-land dates back to the 1930s, when he used to be KA1AK. The Philippines was one of our former territories and was assigned with a KA prefix.

The current president of CLARC is Dr. Ronald Yuson DW2DX. I have known Ronald since his medical internship days. I used to go with him in his rounds in the hospital ward at Central Luzon General Hospital, and also during his duties in the emergency ward. This is where I saw, firsthand, emergency medicine and radio communications hand-in-hand.

Most ambulances are not equipped with radios, as in the States. It is only through amateur radio that quick arrivals of help and diagnosis are made. But unfortunately this happens only when there is a big typhoon or during the Easter holiday when there is a lot of traffic and the government, together with other civic-action groups, invites local hams to help provide much needed communications for emergencies.

DW2DX has been instrumental in a lot of civic-action duties, doubling both as a communicator and a physician when needed. Even though the issue of his callsign came two years after passing his test, DW2DX never got discouraged and found time to be active in ham radio despite raising two harmonics and his medical duties. The local hams and would-be hams should take note and not get discouraged. License examinations and processing do take time, but rest assured PARA and some other well-connected individuals are trying to rectify this pressing problem.

Feb. 16, 1985, was a day to be remembered by the local hams. It was the day of the Hamvention 85. It was held at Camp Concepcion Gonzalez in Novaliches, Metro Manila. It was hosted by several clubs from District 1, and also by the Citizens Band group together

with the Philippine Girl Scouts. The guest speaker was none other than National Telecommunications Commissioner General Ceferino Carreon. There were swap meets, flea markets, a CW contest, and DX contests.

But the significant difference in this year's event was the presence of many OTs mingling with other local contemporary radio enthusiasts. I guess the event's theme, "Unity for Radio," was appropriately embossed in everyone's mind during the whole festivity. More on the Hamvention next time, since there were a lot of activities to be mentioned and lots of film still to be developed!

Speaking of amateur-radio themes, one that comes to mind is this one. "International Friendship and cooperation of all peoples in Asia through Amateur Radio." This, folks, is the theme of the SEANET, the South East Asia Net you can hear operating on 14.320 MHz. The last SEANET convention was held November 16 through 18 at the Eastern and Orient Hotel in Penang, Malaysia.

This net started out as a friendly gathering of Southeast Asian hams on 20 meters every evening but grew to include all other DX stations who regularly check in. Net controllers are VK2MA from Sidney, Tom VS6CT from Hong Kong, and Dr. Ed DU7EG from DU-land. The convention is an annual event and is hosted by the different original Southeast Asian member countries. Last year's SEANET ham attendees were from the Philippines, Japan, India, Thailand, the United States, Singapore, Indonesia, Australia, and Brunei.

The plan for the next SEANET convention is to hold it right here in DU-land. The organizers have eyed beautiful Cebu City as the host city. Cebu is about 600 miles south of Manila, and many domestic flights are available to Cebu City from Manila Domestic Airport. The tentative dates are November 22 through 24, and it is hoped that DU hams will be directly involved in this 15th SEANET convention.

Well, once again we will say 73 for now and hope to bring you another column soon and update you with the Hamvention 85 here in DU-land—and also share with you some pictures of the event. Good luck and happy DXing.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20		40	40	40				20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15					40			20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G = Good, F = Fair, P = Poor.

MARCH

SUN	MON	TUE	WED	THU	FRI	SAT
						1 P
2 F	3 G	4 G	5 G	6 G	7 G-F	8 F
9 F	10 F-P	11 F	12 F-P	13 F-P	14 F-G	15 G
16 G-F	17 G-F	18 G	19 G	20 G	21 G	22 G
23 G-F	24 F-P	25 F-P	26 F	27 G	28 G	29 G
30 G	31 G					

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FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

TELEGRAPHY AND STUFF

As regular "Fun!" readers know, I don't think that a knowledge of the Morse code should be required of prospective radio amateurs.

Call me a radical, call me crazy, but I just don't see how an ability to use an obsolete form of binary communications is going to save our hobby.

Anyway, enough of that. It's time for a surprise. I actually love the code. I don't happen to think the Morse code should be crammed down the throats of newcomers, but I'm all in favor of using it on the air. Sending CW is fun, relaxing, and a great way to relive the historic past of radio. I like it. Call me duplicitous.

Last Christmas, my kid brother, WB2LWJ, gave me a great gift—a Vibroplex semi-automatic keyer (a.k.a.—"bug"). Best of all, it was a presentation model, the type with the gold-plated base.

What a Christmas! I was a kid again, prowling 20 meters for DX, engaging old friends in seemingly endless QSOs, and ditting and dahing away until my ears fairly rang with the sweet music of CW.

My brother tells me he got the keyer at Barry Electronics, a New York ham fixture and landmark. With Harrisons' death, Heathkit gone from the city, "radio row" replaced by the World Trade Center, and Lafayette now into discount VCRs and stereos instead of TR-4Cs and grounding rods, Barry's is the last vestige of a time when the Big Apple was the radio (both professional and amateur) capital of the world.

Anyway, when my brother showed up at Barry's to purchase the keyer, the folks behind the counter thought that 'LWJ was Mr. Fun! They believed that his denials were merely a form of KI2U modesty. How wrong they were. The real Mr. Fun!, although somewhat older, is far better looking than his brother. And KI2U is never modest about anything, except perhaps his ability to run a repeater.

But that's another story. For now, let's stick to CW and its ancestors.

ELEMENT 1
MULTIPLE CHOICE

1) Approximately how many parts are there to a typical Vibroplex bug?
   1) 10
   2) 20
   3) 50
   4) 100

2) Samuel Finley Breese Morse was born in:
   1) 1791
   2) 1815
   3) 1830
   4) 1840

3) Thomas Edison in 1874 created "quadruplex," which allowed a telegraph transmission of:
   1) one message in four directions
   2) two messages in two directions
   3) four messages in one direction
   4) one message in two directions

4) The early submarine telegraph indicated "dits" and "dahs" with the aid of:
   1) a sounder
   2) a deflecting needle
   3) a lamp
   4) an audio oscillator

5) In addition to his inventions, Morse is also particularly well known for having been:
   1) a painter of miniatures
   2) an acrobat
   3) a skilled violinist
   4) an author of romance novels

ELEMENT 2
TRUE-FALSE

	True	False
1) The spark transmitter of Hiram Percy Maxim W1AW was named "Ol' Reliable."	_____	_____
2) Morse's first telegraph link was between Baltimore and Philadelphia.	_____	_____
3) Morse's original telegraph receiver emitted a 10-kHz audio tone.	_____	_____
4) Morse was the first president of the National Academy of Design.	_____	_____
5) At one point, Morse held a chair in Natural Science at Yale.	_____	_____
6) Morse died in 1891.	_____	_____
7) Radio Telegraphy was introduced by Marconi in 1897.	_____	_____
8) Morse added an audio buzzer to his telegraph receiver in 1855.	_____	_____
9) The Vibroplex bug was invented by Horace G. Martin.	_____	_____
10) The first telegraph keys had no knob.	_____	_____

ELEMENT 3
SCRAMBLED WORDS

Unscramble these words relating to telegraphy:

praghyleet	romse	rekye	notedesi	gub
sift	pocy	eky	doce	idt

ELEMENT 4
FILL IN THE BLANK

1) _____ installed the first railway telegraph system in England in 1837.
2) Samuel F. B. Morse was born in the town of _____, _____.
3) First telegraph message: "What hath God _____"
4) The Morse code's "dit" and "dah" elements are separated by an interval that has the duration of _____ dit(s).
5) The "dah" has a duration equal to _____ dit(s).

THE ANSWERS

Element 1:
1—3, 2—1, 3—2, 4—2, 5—1.
Element 2:
1—False, "Old Betsy"
2—False, Between Baltimore and Washington
3—False, It printed "dits" and "dahs" on a slip of paper.
4—True, From 1826 to 1845, after which telegraphy increasingly occupied his time.
5—True, He was an instructor at New York University, located just a little north of Barry's.
6—False, 1872
7—True, And it sort of caught on.
8—False, Morse never did apply a buzzer or other sounding device to his invention. That honor went to a fellow named Alfred Vail.
9—True, Who else? Martin was a turn of the century telegraph operator who invented the bug to relieve arm strain. Many experienced ops thought the device a "sissy key," however. It took a while to catch on.
10—True, No "sissy key" ops back then.
Element 3:
Reading from left to right: telegraphy, Morse, keyer, sidetone, bug, fist, copy, key, code, dit
Element 4:
1—Sir Charles Wheatstone
2—Charleston MA
3—wrought
4—one
5—three

SCORING

Element 1:
Five points for each correct answer
Element 2:
Two and one-half points for each correct answer
Element 3:
Two and one-half points for each correct answer
Element 4:
Five points for each correct answer.

How did you do?

1–20 points—Novice
21–40 points—Technician
41–60 points—General
61–80 points—Advanced
81–100 points—Amateur Extra

73 for Radio Amateurs

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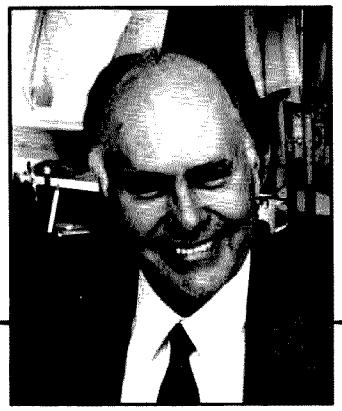
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NEVER SAY DIE



Along about 33 years ago I started a column in *CQ* on RTTY. Yep, I was into digital communications that long ago, for those of you who thought digital was something new. I thought I'd mention that before I tell you I'm looking for some really active hams to do some columns for *73*.

Columns on some special ham interest usually start out like gangbusters, but after a while the columnist usually runs out of steam. As an ex-columnist I know all about that side of the street.

So what I'd like to do is have the best of both worlds—cake and eat it too division. I'd like to see some experts tackle subjects that I know can be very interesting—such as RTTY, SSTV, packet radio, repeaters, UHF, antennas, DXing, ham clubs, mobile, contests, certificate hunting, QRP, facsimile, traffic handling, nets, home construction, and so on. I'm talking about having short, interesting columns—some monthly, some bimonthly—for each special ham interest.

This is the catch: I'll be asking you to vote every month on which columns you enjoy and which you find boring. If a column doesn't make the grade with you, it's out.

Since thousands of hams are interested in every one of the facets of our hobby I mentioned, a columnist should be able to make every column a winner. If I'm able to find someone to report on your particular interest and you allow the column to become boring, you'll lose it. You'll also lose the opportunity for getting a few thousand more hams involved with your special interest—and the opportunity to attract manufacturers to your interest.

If you would like to try out for a column, and for fame and fortune (well, fame, anyway), the route to stardom is simple. First drop me a line explaining what special ham interest you want to write about. Then tell me about your background and why you are the ideal person to tackle this. Third, I'd like to have an idea of your resources: what you've accomplished, who you know, what ham manufacturers may help you, and so on. Fourth, I need to see a couple of sample columns. I warn you, I'm going to read them lying in bed, dead tired. Either you keep me awake in a fever pitch of excitement and get the contract, or I'll save your columns for when I have insomnia.

I do expect you to have a working knowledge of grammar and to either own a dictionary (which you use) or have a spelling checker in your word processor. Once we get started I'll expect to get your material well before deadlines—preferably via a floppy disk or, better, via modem. We're totally automated here, so we don't re-keyboard stuff any more. It all comes in from our writers' computers.

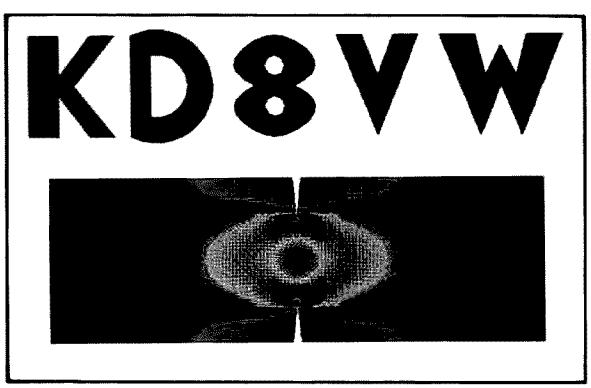
The columns don't pay enough for you to do all that work for the money. We pay around $100 or so, enough to buy a little extra ham gear. The columns should be fairly short, maybe two or three double-spaced printout pages. We're not looking for the Great American Novel; we want to get excited about amateur radio.

One extra spiff, in case you haven't thought about it. Surveys of past authors have shown that being published in a technical journal such as *73* can help substantially when you are looking for a raise or a better job. In general, the rule is that your salary will go up about $1,000 per year for each article you have published. I'll bet it never occurred to you why so many hams were writing articles for ham magazines. There is more than their love of the hobby involved, though that doesn't hurt.

TNS = THE NEW SIX?

Unless you've been holed up in the back of your ham shack, cut off from the real world by an

Continued on page 10



QSL OF THE MONTH

KD8VW's card represents a finite-element analysis of a double-cracked test specimen. The colors show stress patterns. The figure was produced by a VAX 11-785 computer on a Tektronix 4115 terminal.

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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QRX . . .

EDITED BY PERRY DONHAM KW1O

But, Nooo . . .

SOME PEOPLE OUT THERE apparently don't appreciate all the hard work put in by amateur volunteers to ensure continuous communications during an emergency. In a letter to the Cellular Telecommunications Industry Association, **Martin Hertz** (!) of the **Communications Attorney Service**(founded by Richard Cooper) attempted to prove "that the American Radio Relay League and its ham-radio followers are trying to undermine the legitimate commercial radio interests." Attached to the letter was a copy of a story (from *WorldRadio*) which chronicled the exploits of a group of hams who provided a large hospital with emergency communications after the facility's telephones went dead. Hertz believes that this type of assistance is contrary to Part 97 of the FCC Rules and Regulations and points out that, "We in the CAS cannot believe that those who organized [this] radio fiasco could not locate hundreds of thousands of Part 95 licensed Citizens Radio operators to fulfill this duty legally." Finally, the CAS asked the CTIA for "support in neutralizing both the American Radio Relay League and its followers." The Old Man would have applied liberal doses of Wouff Hong to these guys!

Kiri On

T32 EASTERN KIRIBATI will be active during this year's *CQ* WPX SSB test. **Junichi Tanaka JH4RHF** reports that a group of four will make the trip; operation will begin on March 26 and continue through April 2. Look for the DXpedition on all bands, CW and SSB, before the contest. QSLs go to Junichi Tanaka JH4RHF, 146 Kotobuki, Hattori, Toyonaka, Osaka 561, Japan.

Money Matters

TWENTY-ONE SCHOLARSHIPS are available for college-bound hams for the 1986–87 academic year. The scholarships, administered through the **Foundation for Amateur Radio (FAR)**, are sponsored by the Quarter Century Wireless Association, the Dade (Florida) Radio Club, the Baltimore Amateur Radio Club, the Department of State Amateur Radio Club, Radio Club of America, the Richard G. Chichester memorial, the Young Ladies' Radio League, the Edmund Redington Memorial, the Amateur Radio News Service, and the Columbia (Maryland) Amateur Radio Association. Awards range from $350 to $900. Applications and information are available from FAR Scholarships, 6903 Rhode Island Ave., College Park MD 20740—your request must be postmarked prior to May 31, 1986.

Carib Hams QSY

CARIBBEAN AMATEURS may now use voice communications on 7.075–7.100 MHz. The new rule, which went into effect at the end of February, allows hams with General, Advanced, or Extra tickets to use the new segment. The reason for the change is the heavy broadcast interference present from 7.1–7.3 MHz, which renders the band nearly useless during the evening hours. **David Novoa** started the ball rolling back in 1984 with a petition that asked for parity with other Caribbean nations. Most emergency and service activity in the area is located below 7.1 MHz, and, under the old rule, U.S. amateurs couldn't participate in these nets. The FCC felt that the number of potential users of the new segment was so small that additional interference to non-voice communication in the segment would be minimal.

Atari Trick

WOODY GRIGGS WA4NZO has come up with a simple trick for Atari 800XL owners who would like to use Kantronics' Hamsoft RTTY program:

1. Turn your 800XL and disk drives off.
2. Turn on the disk drive.
3. Place a "Translator" disk in the drive.
4. Turn on the computer—do *not* hold down the option key.
5. Once the machine has booted, replace the Translator disk with a DOS 2.0 disk (there should be no auto-run program present).
6. (Here's the tricky bit!) *Carefully* plug the Hamsoft cartridge into the 800XL. If you see garbage on the screen, don't panic!
7. Hit the reset button. Hamsoft is now ready to use.

Planned Band

A NEW BAND PLAN for 902–928 MHz has been adopted by the **Southern California Repeater and Remote Base Association (SCRRBA)**. Representatives of the major users of the new 33-cm band met in Hollywood to discuss interference from non-amateur radio services, and to debate an equitable distribution of the spectrum. The SCRRBA document parallels the ARRL's interim band plan, making certain adjustments for local operating conditions. If you are interested in how the Association developed its proposal, contact it at PO Box 5967, Pasadena CA 91107.

QSL Via . . .

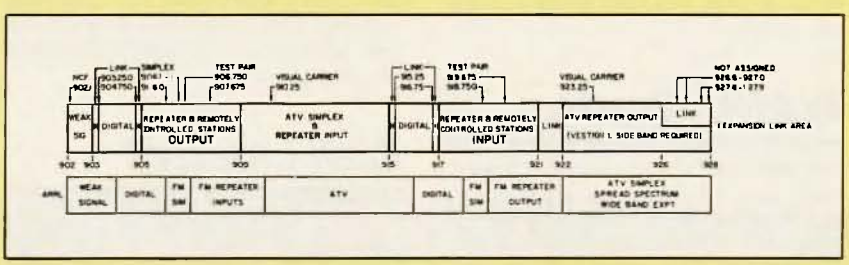
AND NOW a word from **Richard Breckinridge WA9BXB**: "Please be advised that I am now the QSL manager for **Ian Williams VK3MO**." Richard's address is 3827 Kemman Ave., Brookfield IL 60513.

DARA Dollars

TWO $1,000 SCHOLARSHIPS are available from the **Dayton Amateur Radio Association** (the Hamvention people). Any licensed amateur graduating from high school in 1986 is eligible, and there are no restrictions on the student's planned course of study. To emphasize the importance of clubs to amateur radio, DARA asks that each application be accompanied by the recommendation of a local club officer. (Don't worry if you have no club nearby; just have your form signed by a licensed ham.) Entries must be postmarked no later than May 15, 1986, and the winners will be announced in early June. You can get information and applications by writing to DARA, Box 44, Dayton OH 45401. Attn: Scholarship Committee.

Sat Shoot Set

A NEW OSCAR SATELLITE is scheduled to launch this fall aboard a European Space Agency Arienne 4 booster. The Phase 3C bird will carry four transponders for modes B, J/L, L, and S. Mode B uses the familiar 435-MHz



SCRBBA's band plan for 902–928 MHz (above); ARRL's interim band plan.

NEVER SAY DIE

from page 4

electronic ham senility wall, you're probably wondering whether you should cheer or holler bloody murder over the Don Stoner W6TNS proposition that we forever give up the top half of six meters.

Now I have no objection to Don getting rich as Croesus with his new idea. Heck, it might even help a bunch of people get rich—and that's nice too. But there's that niggling question that frankly niggled enough to wake me up at 2 am and get me out of bed to write this. I really hate to be niggled out of bed.

Don's proposal, in case you missed it, calls for us to donate the 52–54 MHz half of six meters for use as a non-ham digital message band. His idea is that there are zillions of computer hobbyists out there who might jump at the opportunity to network over the air instead of by telephone. Moot. I won't go into a long technical explanation of how Don proposes this be done so as to keep TVI to a minimum, so let's just not worry about that part of it. The main question is this: Do we hams need that unused half of six meters for anything anymore?

My first reaction is to admit that no, it sure doesn't look as if we'd be giving up much. But as I think it through I realize there are enough points to consider so I could effectively argue—heatedly, of course—either side of the proposition.

First, on the pro side, I have to admit, as a pro, that the frequencies in question are flat out not being used enough to honestly offer any argument against Stoner. Even more, never in the past have we ever really used or even needed these two MHz for much. To take that one more step—I don't even see any potential use ahead for the frequencies.

To make it even more binding, I remember that we have a dying hobby where we're seeing less and less innovation—even if there was a new technology ahead that might need to use these frequencies, I'm not sure we have enough pioneers to make it happen.

Most of us are so tied up with nightly 75m rag-chewing nets, exacerbating the 20m pile-ups on minor DX, or telling people at great length where we are in our car over a 2m repeater that the top half of six meters is as remote as our going on a DXpedition to Sarawak.

Hey, that isn't a bad idea—remind me to develop that one for you later.

Okay, if we've never had any use for the band—if we're not using it now—and if we don't even have the faintest hint of any future use for the band, why not shut up and donate it to the cause of making Stoner rich? What was it that got me out of bed to write this morning?

History is what done it. Let's go back and take a look at six meters and its history. One of the benefits of being as old as I am is that I'm a living connection to the past. Most of the time this is more of a bore than a benefit, since few younger people want to hear about "how it was." When I start talking about nickel ice cream cones their eyes glaze over.

The six meter band came to us after WWII—I think we got it along in 1946 or so. Before The War we had a five meter band—54–60 Mc. 50–54 Mc was the FM radio band—mostly used by the Major Armstrong experimental FM station in Alpine NJ. Was it W2XEL? After WWII that ended up as TV channel 1 for a while, with 54–60 Mc as channel 2.

This was sorted out by moving FM to 88–108 MHz and channel 1 being changed to the six meter ham band. I was one of the early explorers on six. I was living in Brooklyn at the time and I was the only ham in New York City on six meters. Unlike the old pre-war five meter band, where what little activity there was was made up of little one-tube modulated oscillators, six meters started right out with crystal-controlled rigs.

I could tell exactly who was on the air in a few seconds just by the frequency of the carrier. I had an accurate frequency standard—surplus General Radio LR-1 job—a 94-tube three-foot high kluge. So when I'd hear a carrier I'd just crank the LR-1 until I'd get a beat note and read the call letters off a frequency chart I'd made.

It might be Frank W2AMJ down in New Jersey or Ed Tilton W1HDQ, the VHF editor of *QST* way up in Connecticut. There were just a few of us, so we all knew each other.

I remember a local Brooklyn SWL coming over on his bicycle to visit. He'd heard me talking on channel 1 of his TV set—yep, some of the early TVs had channel 1 on 'em. Years later he got involved with computers as a hobby and opened a successful computer store in Westchester—advertised in my computer magazines.

You know, come to think of it, this early work on 6m was what got me into publishing. In order to keep track of when 6m was opening for DX contacts a number of us put beacon transmitters on 50.1 MHz. I rigged up a code disk with a microswitch to key my 6m rig and let 'er run when I wasn't making contacts.

Perry Ferrell organized a government-sponsored research project to investigate 6m propagation, so I naturally participated with my beacon. Later, when he became the editor of *CQ*, I kept in touch with him, explaining about my work with digital communications and RTTY. This lead to my writing a column in *CQ*. Then, when I helped Perry get a better job as the first editor of *Popular Electronics*, I fell heir to his old job at *CQ*. . . much to my surprise.

Perry edited Poptronics for years—then, in one of Ziff-Davis's larger publishing miscalculations, he was canned. Perry and his wife, Jeanne Gillespie formed Gilfer Associates and sold SWL equipment and information by mail. Perry died a few years ago and Jeanne is still running the business. Say hello to her at Dayton. Better yet, look over her SWL equipment—you might just want a Sony 2002. I've got one and use it every day for time ticks, shortwave, and FM.

Unlike six meters, two was enormously busy in the late 40s. It was a time of change on two, with a few broad old modulated oscillators and an increasing number of crystal-controlled—stabilized, they were called—rigs. I was one of the first to get on 2m with an SCR-522—*the* first, I think.

I remember, when 2m first opened, having a ball with a pair of 6C4 tubes in a grid-modulated long-line oscillator in the trunk of my '40 Ford. The receiver was a super-regen. W2NYC and I would drive to the highest hill in Brooklyn and work over to Staten Island and New Jersey with it.

The next big event was when a ham, George Sterling W1AE, became the Chairman of the FCC. This was when we got our Novice Class license. Novices were permitted voice communications—145–147 MHz. The League was in the hands of an arrogant, foul-mouthed general manager, so the FCC wasn't even talking with them. The ARRL fought the new license class, but were no match for the FCC Chairman. The League has never really accepted Novices as actual hams.

Eventually the FCC discovered that Novices were infinitely more interested in voice than CW communications, with most of 'em migrating quickly to 2m. Unfortunately they then lived out their two-year license on 2m and never made it to General. So they killed the 2m Novice band and brought us the Technician Class license—which the ARRL also fought and has hated ever since. Techs got to use the old Novice 145–147 MHz band—and the six meter band.

Techs took to 6m with a vengeance. Six was hot during the sunspot highs, opening often to Europe and around the country. I worked all over Europe on six meters. When six was hot it would be jammed with stations—almost like CB. Can you imagine tuning from 50.1 on up to above 51.0 MHz and not finding a clear spot to work? There were even a few explorers up in the 51–52 MHz part of the band!

Six stayed a hotbed of Tech activity up until 2m FM and repeaters came along. That got started for real in 1969. By 1973, six was almost deserted. These days you hear an occasional ghost signal on six. Not much doing there. Back in 1972 I cross-banded my 2m repeater to six. That was fun—with occasional contacts out in Ohio, Tennessee or Florida when the band opened.

Six meters never really recovered from the 2m repeater explosion, so it sits there, waiting for some hoped-for technical development that might bring interest to it again. Even the sunspot highs won't do much for it because 6m is mostly an American band. It's used for other services in Europe these days.

Now, to get to a con point. And no remarks about me being a con-man. Up until 2m FM and repeaters came along the top 2 MHz of 2m was almost totally unused. The General Class licensees tended to operate

from 144–144.5 MHz and the Techs from 145–145.3 MHz.

Oh, let me tell a story. Ed Tilton, W1HDQ, got all bent out of shape over some local 2m hams who kept interfering with his DXing on the low end of the band. Ed had a big antenna and plenty of power, so he had a Big Signal. I had a Big Signal from Brooklyn too—with my 16-element beam and a kilowatt. Well, Ed couldn't get a couple of lids to move up the band and let him DX so he got the League to petition the FCC to set aside 100 kHz for CW-only.

Believing that we would do better to reason with lids than to legislate band segments like that, I countered with the proposal to put the CW band at the top end of 2m—147.9 to 148.0. The FCC did just that, to my great delight. Ed had been bragging that he was going to get those damned lids off his frequency. Well, the new CW band got zero use, of course, and eventually it was shifted to the low end, where it's been a royal pain ever since.

Getting back to two meters. There was a strong push by *CQ Magazine* to take the unused 2 MHz—146–148 MHz—and make a CB band out of it. After all, we hams weren't using it and would never need it for anything, so why not? I fought the proposal with *73 Magazine*, and it was defeated. If we'd gone along with the *CQ Magazine* idea that an unused ham band would probably never be needed, we could easily have lost the most used ham band we have today.

So I worry. I see us losing frequencies at every turn. We just lost the low ends of the 420–450 MHz and 1215–1300 MHz bands. No, we're not using these much right now, but I can see some real solid potential for their need—particularly if we ever manage to get amateur radio growing again by getting some youngsters into our hobby.

Will some technical development come along to make us regret donating half of our now dormant six meter band to Stoner's plan? Maybe, maybe not. We can't tell about that any more than we could foresee needing frequencies for repeaters. We sure lucked out on that one.

Now, let's suppose that we do somehow manage to get amateur radio growing—with thousands of ham clubs in schools again the way it used to be before Incentive Licensing wasted them. Let's suppose, even further, that we're able to put together a national digital communications network where any of us will be able to type a message (or speak it into a typer) and have it automatically relayed anywhere in the country. Will we be able to do this without having an unused resource of ham frequencies for this new service?

I can see a network of local digital repeaters—maybe working on the packet principle—tied through satellite links to the entire world. Would we need that 2 MHz of six for this or could we get by with what we have to spare on 2m?

Oh, writing of digital, within a couple years I expect we'll be seeing digital television starting to take over. Our 8mm video tape will go digital, making it possible to relay video any number of times anywhere without even the slightest loss of picture.

Of course there is always the possibility—maybe even probability—that all we will ever need for amateur radio are our old bands where us old timers can hang out and ragchew until we die.

Writing of dying, I've noticed that what used to be a small box in QST—Silent Keys—these days has taken on more the dimensions of a special segment of the magazine. I go through it each month, marking the old timers I've known personally—remembering them. An even better exercise is to join the QCWA and go through their newsletter, which dwells even more on the swelling tide of dear departeds. Probably mostly smokers, eh?

Well, what do YOU think about our giving six meters to Stoner? Of course I'm exaggerating—if Stoner gets his plan accepted we'll see a bunch of firms—Japanese firms, of course—making equipment for the new band. If many people get interested in the new band it could turn into a new industry, complete with a Wayne Green magazine. And think of the potential for selling high powered amplifiers for a one-Watt limited band! Zowie! Shades of CB.

Other than that I like Stoner's idea. I'm not at all convinced the new service would attract many users, but if it did it could be fun.

The millions of home computers do present a challenge. If the people with these could be enticed to network them over the air, it could be a big industry. Surveys have shown these computer owners to be interested in radio communications, but to be so put off over having to learn the Morse Code to get a license as to be unavailable as potential hams.

Any thoughts?

MAKING MONEY

When you think about the enormous shortage of electronic technicians in the United States, you realize that there's lots of opportunities out there for anyone with entrepreneurial leanings to make money. It's so easy for any ham who is really interested to make money that I get a bit annoyed when I hear hams complaining about being short of money. It's out there in gobs.

For instance, maybe 15 years ago I recommended that hams interested in making a few extra bucks could do worse than get into selling alarm systems for homes and commercial buildings. I heard from quite a number of hams who took my editorial seriously and went into the business part time to start, but soon found it far more remunerative than their old job. Many did very well.

Well, that same business is still out there, waiting for anyone with some gumption to get into the business. Today only 8.6% of private homes have alarm systems. You couldn't ask for an easier market!

You can sell and install alarms—all kinds.

Continued on page 91

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LETTERS

WELCOME BACK

Congratulations on your return to being a great ham radio magazine. I subscribed to *73* for many years after it started publishing. Finally, it got so oversized that I couldn't find the time to read it. I dropped my subscription because I couldn't stand to wade through about 180 pages to find two or three articles I liked. I picked up the January issue on a newsstand, and I liked it.

Donald Burr AJ6X
Fresno CA

THE NOVICE DEBATE

I have read in past issues the pros and cons of Novice enhancement. Most of those against it are the ones that are afraid that frequencies might be taken away from them. I have yet to see a band that had barriers that kept higher classes from using Novice frequencies.

Come on, let's all grow up and start looking at the plus side of letting Novices use SSB on 10 meters. When was the last time you actually held a QSO on 10 meters, or heard it being used on a regular basis? Many hams would prefer to have the newer bands put in place of the 28-MHz positions on their bandswitch. Many don't even switch to it or listen to it. Of course this wouldn't open the band up because no one would be talking; everyone would be listening. But by allowing the Novice to use SSB on 10 meters, someone would be talking. With the power output allowed to Novices, they could easily talk 20–60 miles daily. This would not be another 11-meter band. I believe we could control ourselves enough to prevent that. Let's stop crying about what might be taken away, and start looking at the plus side:

1. Hams actually using a band (which would normally go unused) and monitoring it on a daily basis.

2. More chances for DX on 10 meters once other countries know we are using the band again.

3. More chances for Novices to get together and hold a conversation that doesn't take two hours to say how the weather is.

4. More Novices would band together and would be able to offer each other the assistance needed to upgrade.

Numbers 1 and 2 are important to all of us, but number 4 is important as well. It is a lot easier to upgrade to higher classes if you have someone to study with. I believe we would actually have an increase in hams upgrading above the Novice/Technician tickets.

John M. Lothridge WD4NQG
Tampa FL

John, you're probably right about the need to get Novices off CW and onto phone again—also the possibility for getting our many unused bands active by opening them to Novices. But I don't think you'll ever get the League to go along with you, and remember, they can get 1% of the clubs to totally swamp the FCC any time they want. Perhaps the FCC is easily swamped. With ten dead these days, Novices might bring it back to life. And then there's poor old six meters, even deader than ten. Two is pretty occupied, except on the low end—how about a Novice phone band from 144.–144.1? I think we've got a lot of room for Novices on 220 MHz. 432 is busy, at least in Los Angeles. 1250 is wide open—as are all the rest of the bands above that. But John, on #4, you're dreaming. Once Novices get phone privileges you'll never see them make the slightest attempt at going for a higher grade license. That's what we found when they were on 2m and there's no reason to believe you'll see it any different if we try it again.—Wayne.

FIND THE GOVERNOR

This is no doubt one of a great many letters you will receive from Texans correctly identifying Texas Governor Mark White as the man on the left and K5RC as the one in the middle of the "County Bounty" photo in "QRX" (January 1986).

An interesting issue. I enjoyed it.

R.B. Peebler W5KIW
Radio Officer, S.S. *Bay Ridge*

AN UNJUST ACCUSATION

In my four years as an amateur radio operator, I have never heard anything as disgraceful as a recent event on a Long Island NY 2m repeater.

Several stations involved in a round table were interrupted by another station who inserted his call between transmissions. When the breaking station was given the opportunity to speak, a majority of his signal was noise. A control operator then broke in and advised that the interrupting station was not listed in the callbook and was operating illegally.

After repositioning, the station called in again with a full-strength signal. At this point, the control op ordered the station to cease communications at once, saying if the station wished to use the repeater he would have to send a copy of his license for verification purposes. Later, the control op announced he had in fact overlooked the callsign in the book and apologized to the station.

Another station came on to criticize the control op for the manner in which he had handled the situation. The control op informed him he obviously did not have any idea how to operate a repeater. This know-it-all control op was responsible for emissions from the repeater and should have activated some function to prevent the outside station from getting into the machine. Besides, he also violated the rules by directing his transmission to a so-called unlicensed party.

Do you think a new ham would be very impressed with the hobby after having an experience like this? What about the ham who has been licensed 25 years and suddenly changes his callsign? Would that ham now be illegal since he is not yet listed in the book?

Hopefully the control op will use better practices in the future. I'm sure any ham would be just a bit more than angry if he or she was called an illegal operator!

Jeff Gornstein NJ2Q
Springfield NJ

Jeff, it sounds like your control op has a sure cure for a non-jammed repeater. But if that's the worst you've heard, you need to hear some tapes of L.A. repeaters. Hmmm, maybe there's a market for garbage like that—I may be missing an income source.—Wayne.

HELPFUL READERS

Needing a circuit for a Hallicrafter S40A receiver, I wrote to *73*'s "Ham Help" asking for same. I obtained a copy shortly after this request appeared.

I was both surprised and pleased in getting several more copies from other readers. Although I tried to reply to all, writing is difficult for me as I am badly vision-impaired.

It is gratifying to know that the spirit of cooperation and help from one ham to another is still as strong as it ever was. And through the good offices of *73* Magazine others may similarly be helped.

I wish to thank all those who have helped and offered to help me with this project.

Gerald Samkofsky N4ZB
Holiday FL

Gerald, all 73 readers are true-blue, we just won't settle for any other kind.—Wayne.

TURNING OFF TEENS?

In his letter in the January, 1986, issue, Mr. Vrenios came very close to the true cause of the increasing average age of amateurs. As he noticed, this is not a problem unique to amateur radio. The fact is, today's youth are less interested in model trains, stamp and coin collecting, photography and all hobby activities.

Why? Many of today's teens are spending their free time with microcomputers and video games, popular music, and the endless channels of cable TV. Most of these youths will not discover hobbies until they reach college where clubs and organizations promote various interests, or until they mature a little and begin to consider computers as something you use at work, lose their interest in pop music, and grow bored with TV. As a result, the average age of almost all traditional hobby groups is shifting up a little.

While the shifting age of operators is nothing to worry about, declining membership is a real problem. The solution is not changes in the rules, but simple public relations. I won't oppose a no-code license if it will do what its proponents say, but I don't think it will. My experience has been that once a person gets excited about amateur radio, the code is a very low hurdle to step over.

The real problem we have in at-

tracting new members is the uninteresting image of amateur radio today. Too many people view the hobby as a bunch of old men gossiping with each other. This problem has been frustrated by the advent of cheap shortwave receivers and scanners, bought by people hoping to hear stations from all over the world. Unfortunately, these radios and the antennas people use are so poor that they generally end up with only Radio Moscow, BBC, VOA, WWV and the ham down the street. When they do get stations from faraway places, they quickly discover that people in Norway really do speak Norwegian.

So they tune to the amateur bands and gain first-hand experience with what amateur radio is all about, or so it seems to them: endless, purposeless rag-chewing; traffic nets with no traffic; rude contest operators; "contacts" that consist of nothing more than name, location, signal report, and "Send me your QSL card, I need it for my worked-all-states award."

Scanner listeners, meanwhile, are finding that paging has gone digital, that radio telephone has moved to 800 MHz (above the coverage of many scanners), that it's hard to follow a conversation through a trunked repeater system and that a $50 "descrambler" from the local radio shop will not crack Motorola DVP. So they too turn to the ham bands. Here they either find one repeater that's so busy the operators have to fight each other, or 50 repeaters each occupied by one operator with, by strange coincidence, the same call sign as the repeater.

Next time you're on the air, especially you VHF and UHF repeater users, think about this: What kind of image are you presenting to the non-amateurs who are listening?

The real solution to this problem is for local clubs to become more active. I know, in the past, local clubs have tried to maintain a low profile to avoid being blamed for every speck of snow on every TV in the area, but it's time to come out of the closet and make your organizations visible. Let's show the public what amateur radio is really all about: public service, emergency communications, technical development and, of course, a lot of good fun.

Chuck Gollnick KA7QEN/0
Ames IA

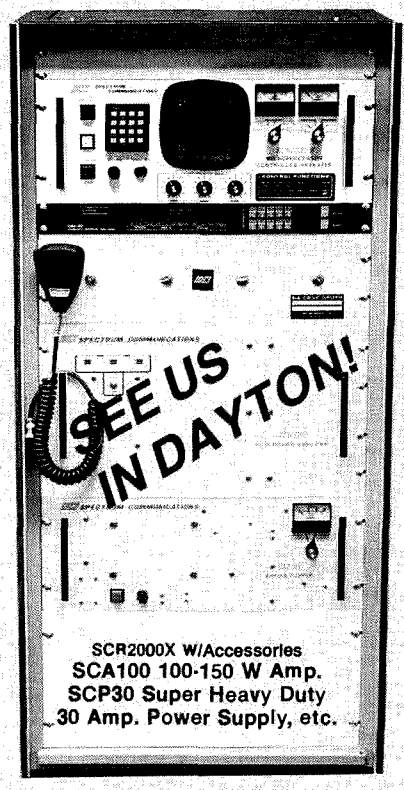
Chuck, I've been hamming for 47 years now and you've described 95% of what I've been hearing for 47 years—endless, purposeless ragchewing, rude operators, pileups, contest-type contacts, and thousands of repeaters with but one operator using 'em. What we have to do is convince kids that endless, purposeless ragchewing and contest-type contacts are by golly real fun. If we promise 'em anything else we're lying. I'd have to lump our public service, emergency operating, technical development and interesting ragchew contacts in the 5% bracket if I were going to be honest.—Wayne.

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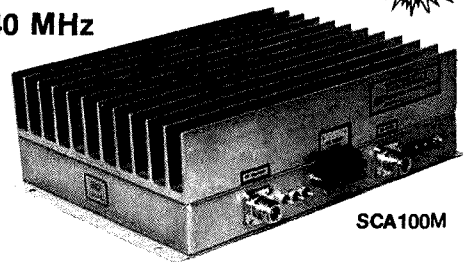
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NEW PRODUCTS

HAPN INTROS PC PACKET ADAPTER

The Hamilton and Area Packet Network has introduced a plug-in terminal node controller (TNC) for the IBM PC and compatibles. The card includes the TNC, a Bell 202-style 1200-baud modem, and a pre-drilled prototyping area.

Bare boards are available for $75, and an assembled/tested unit costs $199; contact *HAPN at Box 4466, Station D, Hamilton, Ontario, Canada L8V 4S7.* Reader Service number 150.

REGENCY HX1200 SCANNER

Regency Electronics now offers the HX1200 hand-held scanner. The HX1200 covers eight bands: 30–50 MHz, 118–136 MHz, 144–148 MHz, 148–174 MHz, 406–420 MHz, 440–450 MHz, and 470–512 MHz. Frequencies may be stored in any of 45 keyboard-programmable channels.

The Regency HX1200 is priced at $369.95 and comes with a wall charger, carrying case, belt clip, flexible antenna, earphone, and nickle-cadmium batteries. For complete details, contact *Regency Electronics, Inc., 7707 Records St., Indianapolis IN 46226.* Reader Service number 151.



Regency's HX1200 VHF/UHF Scanner.

ESP UPS

Electronic Specialists is now marketing an uninterruptable power supply. The UPS is capable of supplying power for up to 20 minutes, and outputs a clean sine wave. The internal batteries are automatically kept at full charge.

Two models are available for power requirements of 250 or 500 Watts. Options include power line phase-lock, blackout illumination, and provision for an external battery.

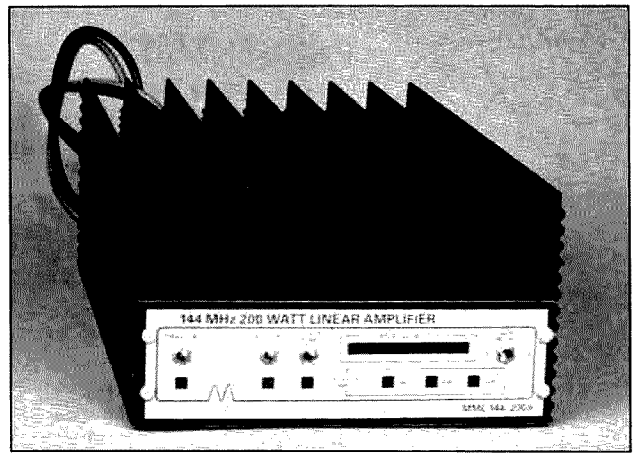
For further information, contact *Electronic Specialists, Inc., 171 South Main St., Natick MA 01760; (800)-225-4876.* Reader Service number 152.

ACC SOFTWARE UPDATE

Advanced Computer Controls has released new software for its RC-850 Repeater Controller.

Version 3.4 supports multiple telephone lines (including up to three lines linked by radio), expands autodial storage to 250 telephone numbers, adds slots for 35-digit dialing sequences, and offers several modes of paging, such as five-tone sequential, DTMF, CTCSS, and HSC. Analog measurements performed by the controller have been enhanced to include stored low and high values on each channel, tagged with the time and the date. The controller also keeps track of internal functions such as number of key-ups or autopatches.

For information about the RC-850 Repeater Controller, or to find out how to upgrade your RC-850 to Version 3.4, write or call *Advanced Computer Controls, Inc., 10816 Northridge Square, Cupertino CA 95014; (408)-749-8330.* Reader Service number 153.



Microvave Modules' MML 144/200S.

SELECTABLE-INPUT 2M AMP

Microwave Modules of Liverpool, England, has announced the Model MML 144/200S 200-Watt linear amplifier for 144 MHz. The input power level is switch-selectable between 3, 10, or 25 Watts, making it compatible with nearly every 2m radio on the market (including hand-helds). Both rf VOX and a manual PTT line are available.

The MML 144/200S also includes a built-in GaAsFET receive preamplifier with a noise figure of less than 1.5 dB.

For complete details about the MML 144/200S, contact *The "PX" Shack, 52 Stonewyck Drive, Belle Mead NJ 08502; (201)-874-6013.* Reader Service number 154.

NEW HEATH HT

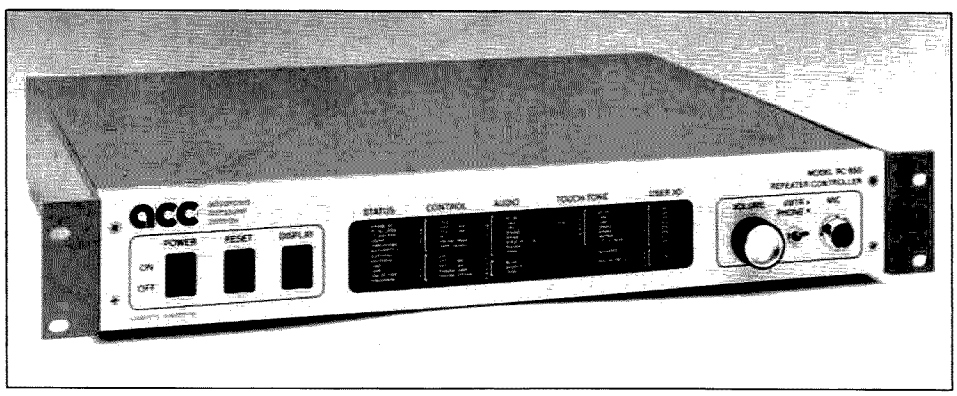
Heathkit has announced the HW-6502 2m hand-held/mobile transceiver. The HW-6502 covers 144–145.995 MHz and has a receive sensitivity of .25 uV.

A mobile console, the HW-6502-2, is available that houses the transceiver and is able to boost the transceiver's output to 25 Watts with an optional amplifier. The console provides power and switching and features a lighted frequency display.

For more information about the HW-6502, or for a complete catalog of electronic products and kits, write *Heath Company, Dept. 150-735, Benton Harbor MI 49022.* In Canada, contact *Heath Company, 1020 Islington Ave., Dept. 3100, Toronto, Ontario M8Z 5Z3.* Reader Service number 155.

CSI MICROMINIATURE ENCODER/DECODER

Communications Specialists has announced the TS-32HB Super-Microminiature Programmable Encoder/Decoder. The encoder comes in two styles: The TS-32HBH measures 1.5"x.65"x .65", while the TS-32HBL is 1.5"x 1.2"x.4". Both units are de-



The RC-850 Repeater Controller from ACC.

signed to fit within the confines of miniature hand-held radios.

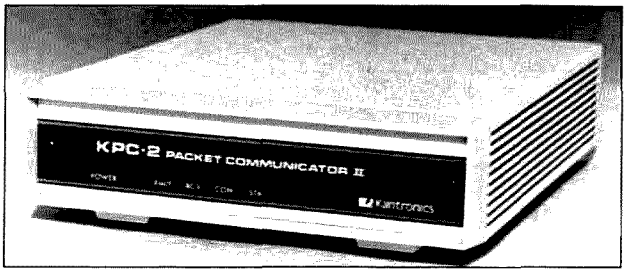
Programming of the 32 available EIA tones is via a board-mounted DIP switch. Input sensitivity is rated at 6 mV rms and the decode bandwidth is ±1.5 Hz. The adjustable output measures up to 6 V across a 10k resistance.

The TS-32HB is available for $64.95; for further information, contact *Communications Specialists, Inc., 426 West Taft Ave., Orange CA 92665-4296; (800)-854-0547.* Reader Service number 156.

A.P.E. DESOLDERING PUMPS

Automated Production Equipment has announced five new hand-held desoldering tools, each designed to address a specific problem in component removal. The DP-1 features all-metal construction and an anti-static tip. Model DP-2 combines an anti-static body with a conductive tip. Models DP-3 and DP-4 are all-plastic; the DP-3 has extra capacity and the DP-4 incorporates a spring-actuated return mechanism. The DP-5 is spring-actuated, conductive, anti-static, and comes with an anti-static tip.

For more information, contact *Automated Production Equipment, 142 Peconic Ave., Medford NY 11763.* Reader Service number 157.



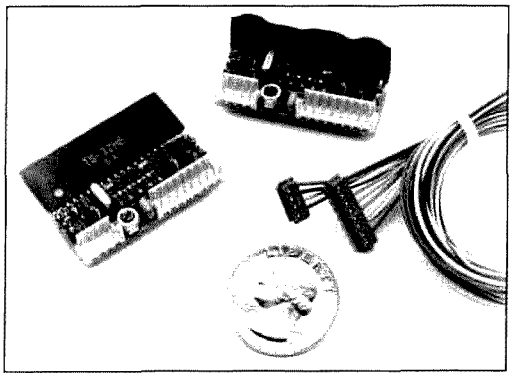
The Kantronics Packet Communicator II.

KANTRONICS KPC-2

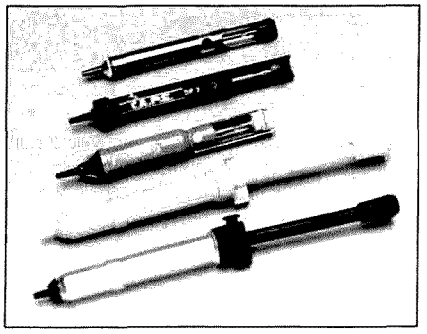
A new terminal node controller, the KPC-2, is now available from Kantronics. The TNC features multiple connects (up to 26 at a time), a built-in HF modem, RS-232C or TTL operation, and AX.25 version 2 protocol.

If you are having trouble easing into packet technology, consider *Basic Packet*, a video tape designed to teach the fundamentals.

For more information about the KPC-2, or about *Basic Packet*, contact *Kantronics, Inc., 1202 East 23rd St., Lawrence KS 66046; (913)-842-7745.* Reader Service number 158.



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The Dayton Hamvention '86

The Center of the Ham Radio Universe

It's almost that time again—time for ham radio's biggest bash of the year, the annual Dayton Hamvention on April 25, 26, and 27.

If you've been to any of the Hamventions over the past 34 years, you know why folks tend to get excited about this time of the year. But if you are one of the few, disadvantaged people who has never had the privilege of spending three days at what some fans call "the center of the ham radio universe," then you've got some learnin' to do.

I'm sure most of you have been to a hamfest and have enjoyed yourself. It's great to check out some of the old and new gear and have a chance to meet some of the old and new hams. And most events feature drawings where you have a chance to win a piece of gear donated by a local dealer. In short, hamfests are a lot of fun.

Now take your local hamfest and enlarge it. Spread out the flea market to cover over 1,500 spaces and increase the inside display area to accommodate more than 200 dealers. Then print up enough tickets, flea market permits, and programs for an anticipated crowd of over 22,000 people. Finally, set up the drawing to have hourly prizes, with the top prize being a complete amateur radio station.

Now make it a three-day, international event and instead of expecting hams from all parts of your home county, expect guests from all over the world. If you can successfully relate those changes to your local hamfest, then you have a good idea of what the hamvention is like. Of course, the best way to know what a Hamvention really is like, is to experience it for yourself!

Planning Your Trip

The first thing you need to do—assuming you're a member of the working class, like most of us—is get off work for the days of the Hamvention, April 25, 26, and 27. Since April 26 and 27 are a Saturday and Sunday, you'll probably need to use only one vacation day, Friday, April 25. Then again, if you need a day to travel to Dayton, also ask for Thursday off. Don't worry about using up two whole days of vacation—the Hamvention is well worth it.

Next, get together with your local hams and find out how many are interested in making the trip. You'll probably find a few who have been before and some others who have wanted to attend but have been waiting to go with a group. Tell them the dates they'll need to be off work, and that they'll probably need about $100 to cover the expense of the trip.

How did I come up with that figure? From experience I can tell you that $100 will just about pay for one person's tickets, share of the food, travel expenses, and motel accommodations. That amount will vary, of course, depending on how far you have to travel, what method of travel you use, where you stay in Dayton and what restaurants you pick, but overall that $100 figure is a pretty good starting place in estimating basic costs. Each year, we travel by car about 500 miles from West Memphis, Arkansas, to Dayton, Ohio, and when we end up splitting the expenses, that's about how much it comes to for each of us. So if you live farther from Dayton, add $25 or $50 to be on the safe side.

Here's a money-saving tip: If you plan early, order your room reservations through Hamvention Housing, 1980 Kettering Tower, Dayton, OH 45401-1980. Most area hotels and motels work with Hamvention Housing and offer a special rate for guests during the Hamvention. Although no reservations are taken by telephone, you can get more information about room rates and locations by calling Hamvention Housing at (513) 223-2612.

Covering Expenses

Now that I've told you how much it should



Photo A. SRO inside the main exhibition hall. Recognize anyone?

cost you to attend the Hamvention, wouldn't it be nice if I had a magic formula you could use to pay for the trip? Hold on to your rubber duckies fellow hams, I'm just about to pass that along.

One of the biggest attractions of the Hamvention is its 1,500-space flea market. It's large enough to cover about two city blocks and it usually contains at least one of every amateur radio doo-dad ever marketed. If you want it, you can find it at Dayton. And if you can't find it at Dayton, you'll probably never find it!

Now, if you'll look around your shack or garage, I'm sure you'll find a few items that you've been meaning to take to the local hamfest and sell. The local hamfest attracts a limited crowd, however, and that certain buyer might not be there. With over 22,000 people attending the Hamvention, that's a problem you won't have at the Dayton flea market.

So here's how to pay for your trip. Order a flea market space for your group when you order your registration tickets. Flea market spaces have gone up this year from $17 to $20, but if you split that four ways, it's only costing you $5 and you should be able to make that back on your first sale. Remember—that $20 pays for the space for all three days!

If everybody in your group brings a few items to sell, then you all can cover your expenses. And if you take turns manning the booth, then everybody gets a chance to make a raid on the flea market. Also, it's a BIG flea market, and few people have the stamina to cover the entire area in one trip. Your flea market space gives you a place to rest. Finally, your space becomes a location for the members of your group to congregate. For all of these reasons, the flea market space is a bargain, and if you work it right, should pay for itself and help you pay your trip expenses.

If you're sold on getting the flea market space, keep these simple rules in mind: Spaces are sold in advance only, and your registration tickets should be ordered at the same time.

Send requests for flea market spaces ($20 each, limit four) and tickets ($8 each) to Dayton Hamvention, PO Box 2205, Dayton OH 45401. In the left-hand corner write FOR FLEA MARKET REGISTRATION.

No bikes, motorized skateboards, or roller skates will be allowed in the flea market. If you plan to use a gas heater or stove, please protect yourself and others and have a fire extinguisher available.

Persons holding flea market permits and registration tickets can enter the flea market beginning at 8 a.m., Thursday, April 24 to set up their numbered, assigned space.

If you have any other questions about the flea market, you can call the special Flea-Market Hotline at (513) 223-0923. You'll be getting your information firsthand since you'll probably be talking to Flea Market Chairman John Grody or his lovely wife, Cathy, but keep in mind this phone is in their home—so try and call before 10 p.m. EST.



Photo B. The flea market stretches on and on.

What You'll See

Okay, now that I've told you where to go and how to pay for it, maybe I could give you a little preview of what you might be seeing at this year's Hamvention.

I've already mentioned that you can expect to run into a crowd of 22,000 people, but let me add that the Hamvention organizers have planned to accommodate such a large group. I've never had to stand in a line longer than one or two people to buy a drink or a sandwich, and if you'll try to eat prior to the noon hour, you should be able to avoid the lunch crowd.

"No bikes, motorized skateboards, or roller skates will be allowed in the flea market."

One other time you might stand in line is to take advantage of an incredibly low price on some of the newest, most popular amateur gear. If you are looking for the best price on that certain piece of equipment you've been dreaming about, you'll probably find it at Dayton.

For example, I found a package of 10 floppy disks to range in price from a high of $12.95 to a low of $7.95. The $7.95 offering was a good quality disk, so guess which one I bought? These quickly sold out but later on, I noticed the $12.95 price had been cut to $10.95 and eventually this dealer also sold out.

This brings up an important point—how low can the prices get and when should you buy? No one owns a crystal ball, but I usually pick a price beforehand that I am willing to pay and if I can get it for that price then I'm happy. In some other cases, when to buy depends on what the item is. If it's a handi-talkie, there's always a great demand at Dayton. They usually sell out fast, so find the lowest price and buy immediately. If it's a high-priced item like a deluxe low-band rig, the demand should be less and you should have more time to shop.

One important buying rule at Dayton: Prices are usually at rock bottom on Sunday when the dealers are packing up, so buy then, or buy on Friday and Saturday but ask the dealer for his Sunday price.

One shopping tip—you might want to jot down on a piece of paper some of the items you definitely want to purchase while you're at the Hamvention. After all, there are three large inside areas for the more than 200 exhibitors in addition to the flea market, and with so much to look at you could forget what you intended to purchase.

One thing I can guarantee you'll see at Dayton is the newest in amateur radio gear. Manufacturers like to display their state-of-the-art gear to the largest crowd possible, and that obviously means unveiling it at Dayton. They might not have gone into production yet on what they show so you might not be able to buy it, but you will definitely be able to see the prototype and get an idea of what the future of amateur radio is going to be.

Dayton also offers the unique opportunity to talk directly with the person who designed a particular piece of equipment. These days you might need to know how to speak Japanese to do so, but in many cases I have found the inventor also manning the booth and available to answer every question you can think of about his electronic brainchild.

The Weather

I have to hand it to the Hamvention organizers! For the last two years they've been able to arrange for absolutely perfect weather. But just because there were clear skies and moderate temperatures for the last two years is no guarantee it will happen again for the



Photo C. Only one more day to go!

1986 Hamvention. In fact, the best way to handle the Dayton weather is to plan for the worst, which could mean freezing temperatures and constant downpours.

Keep this changeable weather possibility in mind as you pack your weekend bag, and let practicality rule. Jeans will be standard, but be smart and toss in long underwear just in case the weather makes a chilling change.

On top, start simply with a T-shirt, then add a long-sleeved shirt (you can roll up the sleeves if it gets too warm), a medium-weight jacket and then finish with a waterproof or rain-resistant coat. Now you're ready for the cold and rain—and if the weather is warm, you can take off the coat and jacket as needed.

One last thing. Bring along a heavy coat and keep it handy. That way, if the temperature takes a deep dip you'll be ready.

The Big Day

After all of the planning, your big day at Dayton finally arrives! It's April 24, you're in the Wright Brothers home town, and you're wondering what is the first thing you should do.

Never fear, your guide is here! My suggestion: take a quick run over to Hara Arena and check the place out. Don't know how to get there? Follow these simple directions. Take Interstate 75 to Needmore Road and exit west, turn right on North Main, then turn left on Shiloh Spring Road, and watch for Hara Arena to be on your right.

Next, you should secure your accommodations. Then, depending on the time you have available, you might want to visit the New Air Force Museum at Wright-Patterson Field (just 10 minutes from downtown Dayton) or the Dayton Museum of Natural History, 2629 Ridge Ave. (home of the Dayton Amateur Radio Association Club station, W8BI).

On Friday, it's a good idea to get an early start, but keep in mind that the Hamvention does not open until noon. That gives you plenty of time to eat breakfast, drive to Hara Arena and get your flea market space ready for customers.

Once the Hamvention begins, persons holding tickets are allowed to wander freely inside and out but are required to show their tickets whenever they enter the indoor exhibits. The first time you go inside, enter through the front doors of the Silver Arena and you'll receive your copy of the official Hamvention program.

Find a seat in the arena stands and take a minute to look over the program and the schedule of activities. You'll see the times and locations for all of the planned forums. These times are definite, and if you wish to attend a particular forum plan your shopping sprees around it.

On Saturday, the flea market opens at 6 a.m., while the inside exhibits open at 8 a.m. Both close at 5 p.m., much earlier than Friday night's closing time of 8 p.m. This is to allow those who are attending the Hamvention banquet time to change and drive downtown to the Dayton Convention Center.

Tickets for the banquet are available for $14 in advance or $16 at the door (if available then), and if you've never attended, maybe you should include this event in your Hamvention plans. Each year at the banquet, awards are given for Radio Amateur of the Year and for special achievements in amateur radio. There is always an interesting featured speaker. Add to that a great meal, and you know why many amateurs consider the banquet the high point of the weekend.

The flea market opens at 6 a.m. again on Sunday and inside exhibits at 8 a.m., but buying and selling activity starts to slow down as the time for the prize drawings nears. Yes, prizes are awarded all during the Hamvention weekend, but for those unclaimed prizes, another drawing is begun at 2 p.m., and is then followed by the drawing for the major prizes at 3 p.m.

Last year, the top prize was a complete ICOM station, so if you feel lucky you might want to stick around on Sunday afternoon!

Additional Activities

There's not enough space here to write about all of the activities that are planned in conjunction with the Hamvention; I have hit only the highlights. There are also alternative activities (formerly women's activities), FCC license examinations, YL forums, CW proficiency awards, and forums on almost any aspect of amateur radio.

The Hamvention also furnishes a shuttle-bus service to carry you to and from all participating hotels and motels, Hara Arena, the Air Force Museum, and to the Dayton Convention Center for the Saturday night banquet.

So this year plan to be a part of the Dayton Hamvention. Get a group together and follow the steps listed below for a very enjoyable weekend at "The Center of the Ham Radio Universe," April 25–27. My guess is that you'll have a fantastic time and find yourself doing what we do on the trip back home—planning for next year's excursion to the Dayton Hamvention!

General Information

- Hamvention Information—(513) 443-7720.
- Flea Market Hotline—(513) 223-0923.
- Housing Information—(513) 223-2612.
- Flea Market Setup Day—April 24. Registration tickets and flea-market permits must be shown together for admission to the flea market prior.
- Prices—Registration Tickets $8 in advance, $10 at door; flea market spaces $20; banquet tickets $14 in advance, $16 at door (if available). ■

CHECKLIST

- ☑ Get the group together to see who wants to go, then figure on how many cars you'll need to make the trip.
- ☑ Talk to the boss and arrange to have April 25 off (and April 24 if you need a travel day).
- ☑ Secure room reservations for the nights of April 25 and 26, and if you plan on arriving Thursday, include the night of April 24 in your reservations.
- ☑ Order your registration tickets and flea market permits early and at the same time.
- ☑ Save your money for the trip and gather your flea market space. Be sure to convert your cash to traveler's checks before leaving home. Don't expect sellers to accept your personal check.
- ☑ Make and carry a list of things you want to buy at the Hamvention. There's so much to see, you might forget what you intended to purchase.

Frank Noble W3MT
10004 Belhaven Road
Bethesda MD 20817

Your Bridge Over Troubled Antenna Tuning

Is your antenna less than ideal? Put more fire in the wire.

The popularity of resonant antennas fed by "flat" coax lines has led to the development of bridges of various types to aid in antenna tuning, line selection, and the design and adjustment of stubs and impedance-matching networks. The proper adjustment of an antenna system requires that a signal be radiated for considerable lengths of time. If you use an appreciable amount of power, this signal may create needless and annoying interference.

The bridge I'll describe here supplies only 2.5 milliwatts to the feedline; it regains sensitivity by employing a dc amplifier between the rectifier and the meter. The internal crystal oscillator will operate at any frequency from 160 through 10 meters on either fundamental or overtone modes. It is crystal-controlled because antenna systems are frequency-sensitive; quartz is the simplest and probably the least expensive way to insure stability. The entire unit, including batteries, is housed in a cabinet so that it can be moved to "where the action is."

The Bridge

A resistance bridge is simpler than an impedance bridge. It shows its deepest null in the absence of reactance. Reactance at the antenna end of a line is never desirable. Hence a resistance bridge is adequate for matching antennas to line provided that it is always used with a repeating line (See Note 1). Referring to Fig. 1, the bridge uses a pot for "differential resistance" balancing. This arrangement yields an open scale in the range 0–5 Ohms, characteristic of low antennas and close-spaced arrays, and an increasingly compressed scale extending to over 1,000 Ohms. In this way, a large range is achieved by a low-resistance pot. It's important to minimize bridge resistances to reduce errors, particularly at high frequencies. It also is important to minimize the capacitance of the pot to ground; this is done by mounting it off ground and using an insulating shaft coupling. The usual precautions of minimizing lead lengths, orthogonal mounting of parts, shielding, and so on, are observed.

The Oscillator

For accuracy, this type of bridge requires a closely sinusoidal exciting voltage. Clean waveforms are easily produced only with tuned-circuit oscillators. A link winding is a simple way to match the oscillator to the low bridge resistance. The Pierce circuit will operate with crystals of highly variable activity. The "Tuned Pierce" circuit will excite the fundamental or odd overtone modes of most crystals, regardless of their labeling—hence the choice of this circuit.

Two ranges are switch-selected: 1.75–7 MHz, and 7–30 MHz. The large ranges are made possible by maximizing the ratio of maximum to minimum capacitance shunting the coils. This is done by the use of a large variable capacitor having a large inherent-capacitance ratio, coils with low distributed capacitance, and care in reducing strays, such as mounting the switch and crystal socket off ground and minimizing lead lengths. The gate is biased by the dc-restorer action of the diode. No source resistor is used because the large g_m at zero bias encourages oscillation to start. Transistor dissipation is within rating at zero bias.

The Dc Amplifier

I selected a dual J-FET op amp because it has high input impedance, low offset voltage, low input current, and internal-drift compensation. The first stage uses the non-inverting circuit so

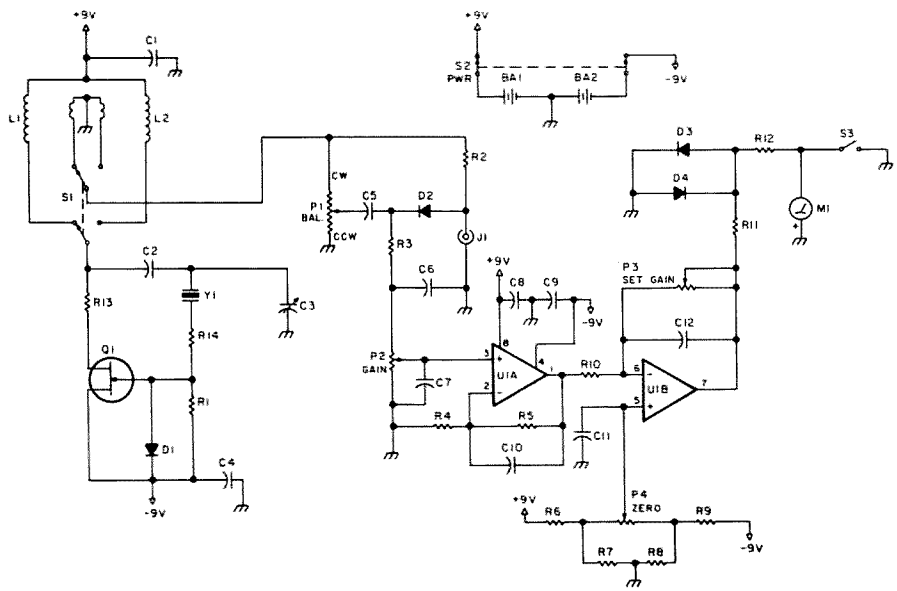


Fig. 1.

that the gain pot may operate into a virtually open circuit, ensuring that the gain of the entire amplifier varies upwards linearly from zero. The gain from pin 3 to pin 1 is fixed at 11. Large capacitors are used throughout the circuit to reduce the gain for all frequencies except dc; limiting the bandwidth suppresses the oscillator signal and reduces noise.

". . . the sensitivity is adjustable over a very large range. . ."

The second stage uses the inverting circuit with gain adjustable from zero to 10 by means of a variable feedback resistor. The zero pot supplies a small variable bias of either polarity to a virtually open circuit. This bias neutralizes the offset voltages of both amplifier stages. It also is useful for setting the meter upscale so that the null is more easily observed.

The meter is protected at about twice full scale by the back-to-back silicon diodes, which are in turn protected by the 1k resistor. The amplifier is internally protected. The meter shorting switch is used to eliminate transient deflections caused by battery switching.

Calibration

Although a theoretical calibration is easily derived, it is not accurate because the pot is not exactly linear. Accurate calibration is made by connecting resistors of known value to the rf connector, balancing the bridge, and marking the scale accordingly. The half-Watt carbon resistors are soldered inside PL 259 connectors and, when cool, bridge-measured at dc. An ohmmeter may be used if the lower accuracy is tolerable.

Substitutions

Use the specified coils; otherwise it may not be possible to achieve the wide tuning range. Some careful pruning may be required anyway because of variations in wiring and parts placement.

Under no circumstances substitute for the balance pot. The Ohmite AB pot is the best affordable component available. It has low inductance and capacitance, and it's quiet.

Bridge Operation

UHF parasitic oscillations indicate their presence by tunable meter indications not controlled by the crystal. They were suppressed in this case by R13 and R14. Crystal modes are easily identified because the tuning is asymmetric and abrupt. It's best to check the oscillator on a receiver to be sure it is crystal-controlled and starts dependably. This adjustment may then be forgotten until the frequency is changed.

The null position is set by turning the gain pot to zero and moving the meter pointer a few divisions upscale by means of the zero pot. This setting will be stable for a long time. The operation of the bridge is like that of any other bridge except that the sensitivity is adjustable over a very large range—in fact, the maximum usable sensitivity is set by brush noise in the balance pot.

Antenna Tuning

Since the subject is complicated, I'll limit discussion to the procedure for the horizontal half-wave coax-fed dipole with a 1:1 balun. The best that you can do here is to resonate the antenna and measure its feedpoint resistance. You can then make a decision on a method of feeding it.

The antenna is connected to the bridge by means of a repeating line that is long enough to reach from the final position of the antenna to the ground. (See Notes 1 and 2.) This brings the bridge, in effect, to the feedpoint, but the operator and the gear are safely on the ground where, because they are well removed from the radiating wire, they do not distort the field. Starting with the antenna symmetrical and too long, consecutively null the bridge and make small symmetrical changes in antenna length until the deepest null is obtained (See Note 3). Here the antenna is resonant, the reactance is zero, and the bridge reads the feedpoint resistance.

In the unlikely event that this resistance matches a standard coax, the appropriate line may be connected and run any length into the shack. In any other case there will be standing waves on the line and it matters how long the line is. Even though the feedpoint impedance is a pure resistance, the input impedance of the line will have reactance unless it is either a repeating or an inverting line. (Notes 4 and 5.)

The inverting line may be useful in two cases. When the feedpoint impedance is 33.3 Ohms, a 50-Ohm inverting line will make the input impedance 75 Ohms. And when the feedpoint impedance is 112.5 Ohms, a 75-Ohm inverting line will make the input impedance 50 Ohms. I have used the first arrangement with a very low dipole. The second may not be practical, since theory asserts that the maximum feedpoint resistance is less than 100 Ohms.

Probably the best solution is to install a repeating line having Z_o closest to the feedpoint resistance so that the swr will be minimized. If the transmitter will not load properly, the line-input impedance may be transformed to 50 Ohms resistive by means of a pi section filter or other simple matching network.

Discussion

All antennas are less than ideal due to economic and physical restrictions, but a given antenna will work better if it has more current in it. It will have more current in it for a given transmitter dc input power if it is resonant

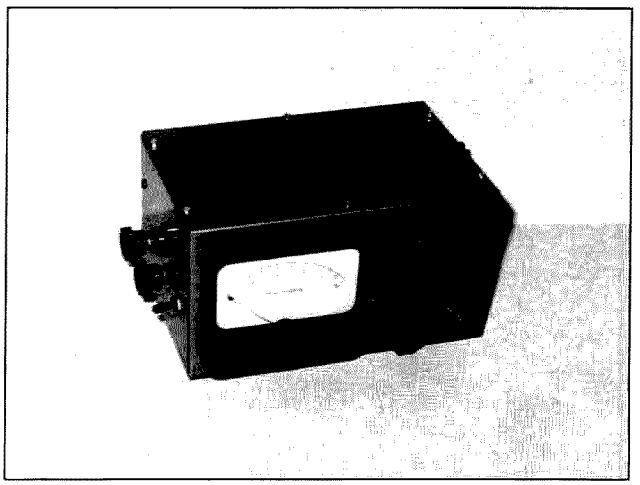


Photo A. Side panel. Back to front: P3, P4, S3.

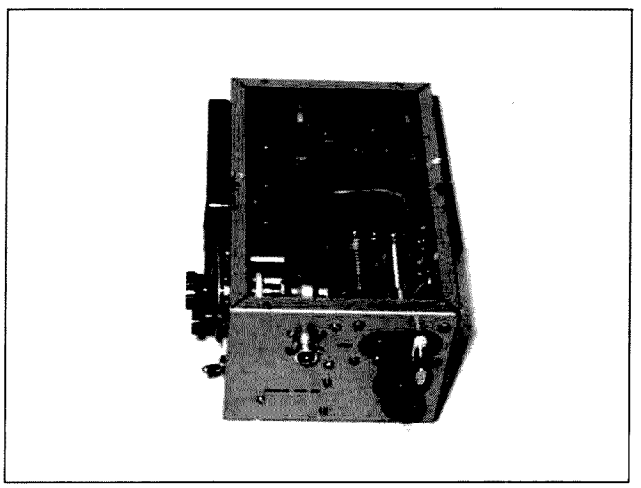
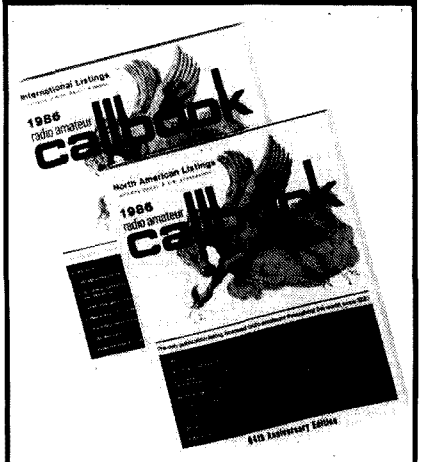


Photo B. Inside. Rear, dc amp, front left, P1, center, L2, L1, right Q1 strip. Panel, upper row, J1, S1, Y1, lower right, C3. Batteries left of C3.

1986 CALLBOOKS



The "Flying Horse" has a great new look!

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The Callbook Supplement is a whole new idea in Callbook updates. Published June 1, 1986, this Supplement will include all the activity for both the North American and International Callbooks for the preceding 6 months.

Publication date for the 1986 Callbooks is December 1, 1985. See your dealer or order now directly from the publisher.

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and properly fed. This bridge will enable you to adjust the length to resonance, and will also suggest the best method of feed. Use it to get more "fire in the wire."

Notes

1. A repeating line is an even multiple (2, 4, 6, etc.) of a quarter-wave long, electrically. Its input impedence is equal to its terminating impedence. For this application, its surge impedence does not matter.

2. Measurements made in other than this final position will be of little value because the feedpoint impedence varies widely with antenna height and position with respect to other objects.

3. Shortening each end of a 40-meter dipole by one inch will raise the antenna resonance about 18 kHz. The effect increases roughly with the square of frequency, i.e. $\Delta f(kHz) = f(MHz)^2/2.72$ approximately.

4. An inverting line is an odd multiple (1, 3, 5, etc.) of a quarter-wave long, electrically. It obeys the relation $Z_i = Z_o^2/Z_T$ where Z_i is the input impedence, Z_o is the surge impedence, and Z_T is the terminating impedence.

5. Terman (*Radio Engineers' Handbook*, 1st edition, McGraw Hill, 1968, page 186). Eq. (62) may be written $y + A \cos \theta + j\, B \sin \theta / B \cos \theta + j\, A \sin \theta$, where $y = Z_i/Z_o$, $A = Z_T$, $B = Z_o$, and θ = angular length of the line. (Or see any text transmission lines.)

Multiplying the numerator and denominator by the conjugate of the denominator will result in the denominator becoming a pure real number. For this proof we find the cases where the resulting numerator is a pure real number. It is $g = (A \cos \theta + j\, B \sin \theta)(B \cos \theta - j\, A \sin \theta) = AB\ (\cos^2 \theta + \sin^2 \theta) + j\ (B^2 - A^2) \sin \theta \cos \theta = AB + J\ 1/2\ (B^2 - A^2) \sin 2\theta$.

We exclude the case where $A = B$ because we are considering only lines mis-terminated in a pure resistance. G will be a pure real number only when $\sin 2\theta = 0$, which occurs only when $\theta = n\ (90°)$, where n is any integer. Since 90 degrees is an electrical quarter wave, the input impedence will be a pure resistance only for line lengths an integer number of quarter waves long, electrically. This means that either a repeating or an inverting line must be used to avoid reactance in the line output impedence. ■

Parts List

BA1, BA2	9-volt transistor battery
C1, C2, C4, C7–C12	0.05-µF, 50-volt disc ceramic
C5, C6	0.1-µF, 50-volt disc ceramic
C3	730-pF air variable (dual 365 pF with sections paralleled)
D1, D3, D4	1N914 silicon switching diode
D2	1N34A germanium point contact diode
J1	SO-239 rf connector
L1	64T #24 tinned wire 1/2" i.d. 2" long B&W Air Dux #432-T (entire coil) link 6T hookup wire. Substitution not advised.
L2	12T #18 tinned wire 1/2" i.d. 1 1/2" long B&W Air Dux #408-T (remove 4T) link 3T hookup wire. Substitution not advised.
M1	50-µA meter, 1.9k internal resistance
P1	100-Ohm pot, linear taper, Ohmite Type AB Style CMU 1011. *Do not substitute*. Mount off ground.
P2	50k linear taper pot, Ohmite Type AB
P3	100k linear taper pot, Ohmite Type AB
P4	10k linear taper pot, Ohmite Type AB
Q1	N-channel FET (Radio Shack #276-2035)
Resistors all ½-Watt carbon composition	
R1	220k
R2	50 Ohm (select from 47-Ohm stock)
R3	8.2k
R4, R10	10k
R5	100k
R6, R9	47k
R7, R8	680 Ohm
R11	1k
R12	4.7k
R13, R14	22-Ohm UHF parasitic suppressors *required*
S1	DPDT toggle (mount off ground)
S2	DPST toggle
S3	SPST toggle
U1	Dual BiFET op amp Type LF 353 N (Radio Shack #276-1715)
Y1	Ceramic crystal socket for HC6/U; Crystals (mount off ground)
Cabinet	5 x 6 x 9 Bud AU 1040, CU 1099, etc.

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Stretch the GP Antenna to the Max

This, the simplest of all antennas, has much to recommend it.

If you've worked a number of Eastern European stations, you've probably been told by some of them that they were using a GP (general purpose) antenna. As their signal is often adequate despite quite modest power, you may well ask what is the secret.

A GP antenna is just a length of wire, usually as long and as high as circumstances permit. Such a wire will have a particular impedance at a particular frequency. Provided that this impedance (which will normally vary from band to band) can be matched by means of a suitable ATU to the output impedance of the transmitter (usually 50 Ohms), it will radiate. It will often radiate well because there are no feeder losses, and moving from one end of the band to the other presents no problem if the ATU is retuned. Although the GP is basically a multiband antenna, its radiation pattern will vary on different bands.

There are a few disadvantages. One end of the antenna is in the shack, which may be dangerous because of high rf voltage. There is also a greatly increased likelihood of causing RFI in the building. At low power, however, these disadvantages are minimal and they can often be overcome even at higher power.

The classical ATU is shown in Fig 1. If the antenna impedance is low, the antenna tap is moved down the coil until proper loading is obtained. Because this presents difficulties when the antenna is nearly an odd number of quarter waves in length, it then becomes necessary to use series tuning.

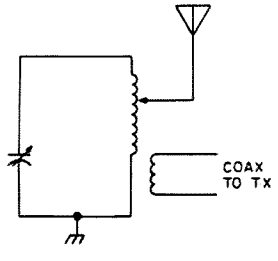


Fig 1. The classical antenna tuning unit.

You'll notice that there is a connection to ground from the bottom of the coil. Textbooks usually state that this should be as short as possible, and that the actual ground should consist of several copper rods. That's fine if your shack is in a hut at the bottom of your garden, but what do you do if you live in a 20th-floor apartment and, even if you get permission to run a wire down the building, can't bury the copper rods in the paved sidewalk?

"Although the GP is basically a multiband antenna, its radiation pattern will vary on different bands."

In recent years, this problem seems to have been side-stepped by using one of the newer forms of ATU. The Collins Universal Coupler (or π coupler) was around before World War II; since then there has been a spate of ATU designs, each claiming to be better than the last. Many of these designs avoid the link coupling shown in Fig 1. The ground connection is provided through the outer braid of the coax from the transmitter, and is usually connected to the common grounding system of the house wiring.

In most cases, this will work splendidly. I have had contacts with all continents using a π coupler and a length of wire thrown out of a bedroom window. However, as mentioned earlier, rf can appear elsewhere in the building. When other equipment is connected to the common grounding system, serious RFI might result, and standing waves on the grounding wires could cause high rf voltages in the common grounding wire! Except at low power, care is needed.

Many years ago, W3EDP suggested a solution to many of these difficulties. His antenna was 25.6 m (84 feet) long and used a short counterpoise in place of the ground connection. These lengths avoided tapping down the coil to obtain proper loading. His original ATU circuit involved inductive coupling between the PA output coil and the ATU coil. This arrangement is no longer practical. Recently, W3EDP's circuit has been rediscovered in Europe (see "Technical Topics" by Pat Hawker G3VA, *Radio Communication*, January, 1985, p. 35) and is proving quite popular. Link coupling is now used between the transmitter and the ATU.

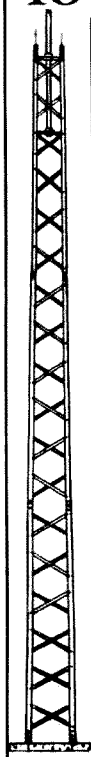
Fig. 2 gives the circuit. The variable capacitor should have about 1.5 pF for each meter of wavelength; a 150 or 200 pF capacitor will cover all bands from 3.5 MHz to 28 MHz with suitable inductances. Details of the coils and counterpoises for each band are contained in Table 1. It is helpful to have a tuning indicator as the tuning is quite sharp; a 500 uA meter and any small rf diode will suffice.

Wires from the meter are fixed near the ends of the tuned circuit to give slight capacitive coupling and the variable resistor adjusted to give a reasonable reading on the meter. Note that this reading will vary from band to band and is to be used only for tuning purposes. Because it does not indicate power level, the comparison of readings between different bands is quite meaningless.

Formerly, plug-in coils were common and would have been used for L1/L2. These are still around, but if you can't find any, wind the coils on a suitable bit of insulating material and glue this to an old tube base (if possible, use a UX4 as it has bigger pins than an octal one). This procedure may seem old hat, but it avoids the difficulties of using switches for the coils.

The W3EDP version of the GP obviates many of the difficulties associated with the use of a ground connection. There is still need for care to avoid burns from the antenna and, as there is no dc connection to ground, the antenna could be dangerous during a thunder-

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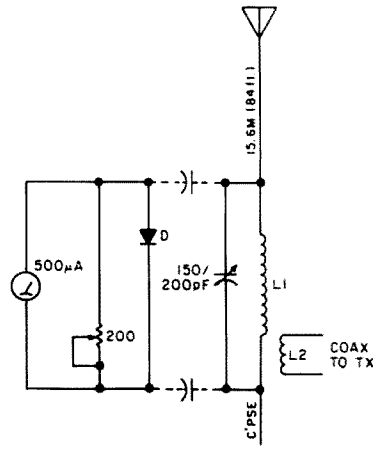


Fig 2. W3EDP antenna and ATU. D is any small rf diode. L1 and L2 are wound on a 3.8 cm (1½ inch) diameter former. For number of turns and details of counterpoise, see Table 1.

Band MHZ	L1 (turns)	L	Counterpoise
3.5	21	4	5.2 M (17 ft.)
7	7	2	5.2 M (17 ft.)
10	4	1	2 M (6.5 ft)
14	4	1	2 M (6.5 ft)
18	4	1	1 M (3.3 ft)
21	4	1	1 M (3.3 ft)
24	4	1	–
28	4	1	–

Table 1.

storm when very high voltages might develop. Otherwise, the W3EDP antenna is particularly useful in locations where the erection of more conventional antennas proves difficult. RFI can often be prevented by changing the direction of the counterpoise.

The GP antenna need not be a straight piece of wire. There is a story—I can't vouch for its truth—that during World War II a clandestine operator in occupied Europe regularly sent out traffic using his bedspring for an antenna! In circumstances when it is not desirable to advertise one's presence, the GP antenna may often be disguised to look like something else. It may even be made of very fine wire, which is invisible from ground level (especially if the glint of the copper wire is removed by passing it through a candle flame). It can be folded or wrapped around an insulated tube such as a piece of plastic piping.

For portable or mobile use, a GP antenna has much to recommend it. Instead of feeding a whip by means of a coax, make a direct connection to the ATU and you have a portable/mobile antenna that can be made to resonate any part of any band. With a little care the GP, which is surely the simplest of all antennas, still has many uses. ■

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The Care and Feeding of a Curved Linear Array Antenna System

For low cost, very low maintenance, yet acceptable performance, try this antenna system for use in high-frequency amateur radio operations.

This article documents the performance characteristics of a 39-element curved linear array (CLA) antenna. The system is fully tunable for all amateur bands, costs less than many other antennas (in fact, many hams already have one, if they only realized it), and presents several unique advantages, which we shall discuss later.

Design Considerations

The primary motive in designing this antenna system was aesthetic acceptability. Not necessarily mine, I hasten to add. To put it more clearly, I wanted to be able to do amateur radio without getting thrown out of the mobile home park I'm currently living in.

One highly desirable solution had, unfortunately, been eliminated by the removal of a large pine tree a couple of years before. Said conifer would have provided excellent camouflage for a multiband vertical.

An indoor longwire was tried briefly, but had a disturbing tendency of creating large amounts of rf inside a metal box (the mobile home). This solution was, therefore, quickly discarded.

Being newly upgraded and eager to get on the low bands after five years on VHF, I was desperate for an answer. Considerable discussion ensued among my ham friends about the project, much of it speculative at best. Given that I had a massive amount of aluminum at my immediate disposal, several friends suggested that I load up the mobile home itself. I quickly realized, though, that none of them had offered to be inside the house when this was attempted.

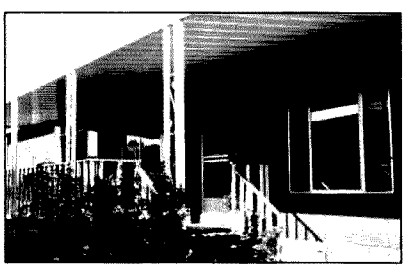


Photo A. The Curved Linear Array antenna, shown installed at the QTH of N6BIS.

". . . a rabbit living in a metal cage on the porch showed no ill effects from my DXing."

Finally, I threw the problem over to Bob Tarone WA6ZBX, who was willing to find the right solution for the situation. Hence his creation of the CLA, or "awntenna."

Specifications

The system we finally implemented is, essentially, a fat longwire. It consists of a 9 by 40-foot sheet of corrugated aluminum—in the common vernacular, a porch awning (see Photo A).

The term "39-element curved linear array" is a straightforward description of the antenna: there are 39 ridges in the aluminum sheet, each of them is curved (arched), and they are arrayed linearly with respect to each other. (There are also five smaller pieces of aluminum holding the thing up, but we try to ignore them.)

The awntenna is fed by a length of four-conductor copper wire (courtesy of Pacific Telephone) from an MFJ 901 tuner and a Heath 104A HF transceiver. (See Photo B.) Maximum PEP output from the Heath is 100 Watts; I have no particular desire to feed more rf than that into the awning.

The height above average terrain (HAAT) is about 9-1/2 feet. It is slightly higher on the side nearest the house, slightly lower away from it, creating a slope of approximately 5 degrees. The lengthwise dimension of the system is oriented almost precisely east-west.

The antenna is not in electrical contact with the house, so far as we can tell. A few short screws attach it to the wood paneling on the side of the house; evidently, they do not go through to metal. Two L-brackets which had secured the awning to the rain gutter were removed during original implementation of the system.

The five uprights are not electrically isolated from the antenna, but are insulated (via mylar booties and plastic bolts) from the cement into which they are bolted.

The awning also does not come in contact with the porch below it. This was proven conclusively in early tests, when a rabbit liv-

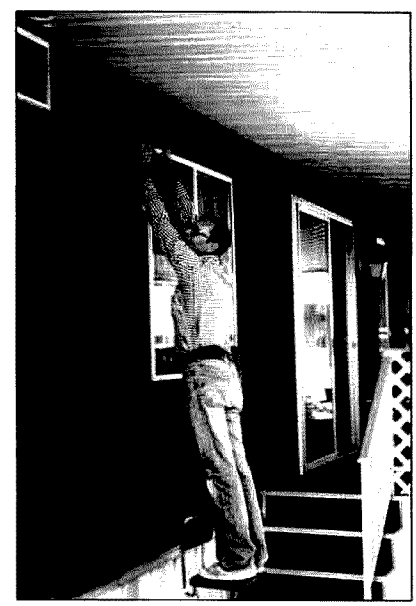


Photo B. Bob Tarone WA6ZBX hooks up the feed line for the awntenna.

ing in a metal cage on the porch showed no ill effects from my DXing.

The antenna is grounded with a short length of four-conductor wire (again courtesy of Pacific Telephone) to a three-foot ground rod driven into adobe earth. A 65-foot dual counterpoise (full-wave at 20 meters) was tried briefly, but discontinued when I discovered that keying up on 15 meters triggered the fluorescent lights in my slide-viewing table.

Total costs for the system were approximately $3(for the ground rod). I already had the antenna tuner and the feedline. Of course, I also already had the awning, saving me some $400 to $500 right there.

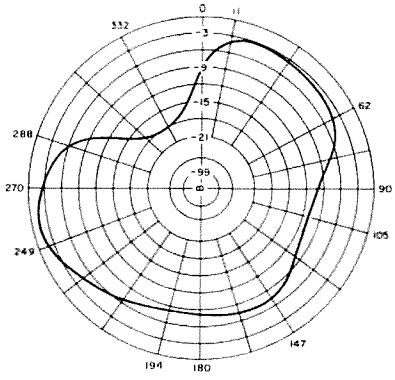


Fig. 1a. The predicted radiation pattern for the CLA.

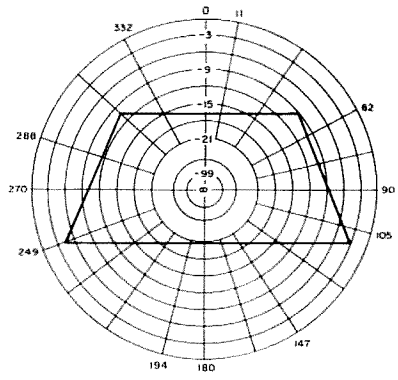


Fig. 1b. The actual radiation pattern for the CLA.

Performance

The CLA antenna has been successfully used on all standard amateur bands from 10 to 80 meters, and tunes quickly to 1:1 (or nearly so) on all of them. It does show a certain sensitivity on some bands, but on others it is nearly flat across the entire spectrum.

Due to this impressive performance, I only need one antenna, and therefore never have to worry about whether the correct antenna is in the circuit. I have been known to nab DX stations while friends were still switching antennas.

The predicted and measured radiation patterns for the system are shown in Fig. 1a and 1b. The pattern turned out to be a sort of casual cardioid, with a definite dip towards the north-northwest. This dip is probably caused by the signal going directly through the mobile home, although we're not certain.

As mentioned, the system points almost precisely east-west, but radiation measurements show no particular preference in these directions (or, for that matter, in any others). However, as of this writing, I have used it at 100W to work all 50 states and nearly as many countries. Signal reports tend to be only fair (typically 5/5-5/7), but, after all, DXCC certificates don't come with special endorsements for being 20 over 9.

Unfortunately, the system does lack pointability. Orienting it to a certain direction would involve rotating the entire house, which would subsequently result in major problems—especially with the neighbors. On the other hand, I never have to worry about which way my antenna is pointed, since I have no choice in the matter. I can concentrate on calling while others are still fussing over great-circle maps.

Polarization, direction of current, and phase relationships in different parts of the system have not been measured. Neither, unfortunately, has gain, since I have been unable to move the antenna to a proper testing facility for precise analysis. However our guesstimates put the gain somewhere between −3 and 0 dB.

Additional Benefits

The CLA antenna requires no maintenance, aside from occasionally sweeping the leaves out of it. In fact, no adjustments are *possible*, a boon to those of us who like to just hook up the equipment and go—although admittedly frustrating to those who feel obliged to tinker with their amateur radio gear.

Since there are no moving parts, there's really nothing that can fail. I never have to worry about my rotor dying with the antenna pointed south just as JY1 comes on the air. (Of course, I probably won't even *hear* him anyway, so I won't suffer by knowing what I'm missing.)

The system has the additional advantage of providing shade on hot days—a benefit that hams with much more expensive (and supposedly better) multi-element beams certainly cannot claim.

Backup system

In case my primary antenna should ever fail (i.e., fall down), a backup system is kept nearby (see Photo C). This system is a verted vee, a variation on the more common inverted vee. Informally, this type of antenna is known as "rabbit ears."

One problem with the verted vee is the exceedingly high capacitance between the elements; it's evident that the phrase "dumb bunny" was not created haphazardly. On the other hand, the high density dielectric results in a high amount of capacity loading, thus accounting for its ability to resonate even on 75 meters despite its apparently short element lengths.

Unfortunately, the verted vee system is more appropriate for mobile operation. It is, in fact, *overly* mobile, and keeping it connected to the radio presents considerable difficulties. Luckily, I have never had to use it.

Possible Improvements

Although the CLA system has been working very satisfactorily, several uninvited suggestions have been made for improving it.

The most obvious is to hook together all the mobile home awnings I possibly can, to provide an effectively larger antenna. With some 800 homes in this park alone, and three similar parks nearby, the prospects are truly awesome (or awful, as the case may be). Better yet, of course, would be a system that allowed connection of different houses at will to create the optimum pattern for reaching each target station.

Currently, the antenna is corner-fed. There has been some speculation on whether center feeding would favorably affect the radiation pattern. Since there is very little literature on feeding awnings (other than that they like a little roughage occasionally), any expert comments on this would be welcomed.

Summary

We have considered the design and performance characteristics of a 39-element curved linear array (CLA) antenna system for use in high-frequency amateur radio operations. We have found that this system offers low cost, very low maintenance, and yet acceptable performance.

Exact technical specifications, costs, and installation instructions for this antenna are not available from the author, but may be obtained from Sears Roebuck and similar vendors.

My gratitude in preparing this article goes to Bob Tarone, WA6ZBX, for the antenna concept and construction; to Kit Blanke, WA6PWW, and Glenn Thomas, WB6W, for their assistance in performing the radiation pattern measurements; to Stephen Greenberg, for coining the term "curved linear array;" and to all of the above for contributing valuable jargon with which to properly obfuscate the subject. ■

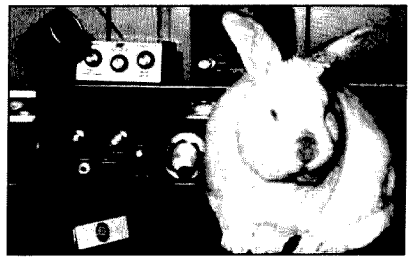


Photo C. The verted vee ("rabbit ears") backup antenna system for the N6BIS station.

Harry D. Hooton W6TYH
1420 Shamrock Lane
Lincoln CA 95648

Stacked Vee-Beam Arrays

If 15 meters sounds dead, you're not using the right antenna!

I am constantly surprised at the number of retired people who have moved to the warmer climates, particularly in the Caribbean area, who use amateur radio to keep in touch with relatives and friends back in the old home town. Most of these people, relative newcomers to ham radio, are not technically sophisticated in the art of antenna design, are limited in income, and depend on inefficient vertical radiators to maintain daily communication.

Many of these hams have sufficient space in which to install a low-cost wire antenna that will give greatly improved performance on both transmitting and receiving. The vee beam for 15 meters, believe it or not, does not require a site in the Sahara Desert to be effective. Besides, a vee system that will double or quadruple your effective radiated power can be built for less than the price of a dinner for two in a good restaurant. Interested? Read on.

Basic Vee Beam Array

The vee beam antenna, originally called the RCA Model D array, is one of the oldest directional antenna systems still in use on the shortwave bands. It was designed originally for commercial overseas radiotelephone service long before the advent of the yagi and other compact arrays. While a vee beam for 40 or 20 meters requires a large area to obtain a high degree of gain and directivity, a similar array for 15 or 10 meters isn't excessively large. For the higher frequency bands, a vee will provide worthwhile gain and directivity even when the legs are as short as two wavelengths, and you can still get some gain when the legs are as short as one wavelength long. The main disadvantage of the short vee, besides having less gain, is that it can't be used with good results on more than one amateur band.

For a frequency of 21.3 MHz, the length of a one-wavelength leg is 45 feet, 4 inches. Two wires in the vee arrangement will produce a bidirectional gain of about 2.1 dB over that of a horizontal half-wave dipole operated under the same power and height conditions. In this case, the apex angle should be 90° for best results. For legs two wavelengths long, the gain rises to about 5.5 dB, and the apex angle is reduced to 70°. For legs three wavelengths long or longer, refer to Table 1.

SPECIFICATIONS FOR 21.3 MHz

WAVELENGTHS	LEG LENGTH (FEET)	APEX ANGLE (DEGREES)	DIMENSION D (FEET)
1	45.04	90	63.7
2	91.24	70	104.67
3	137.44	58	133.26
4	183.63	50	155.21
5	229.83	45	175.90
6	276.03	40	188.81
7	322.23	38	209.67
8	368.42	35	221.60
9	414.61	34	242.44
10	460.81	32	254.033

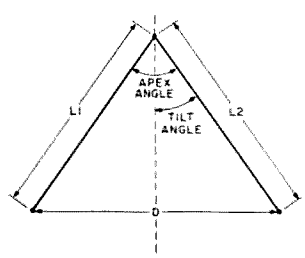


Table 1. Important dimensions of vee beam antennas.

In the absence of tabulated data, the apex angle can be made equal to twice the lobe angle of a single wire of the same length. To roughly determine the gain of the vee beam, compared with a longwire of the same number of wavelengths, add 6 dB to the gain of a single leg operated alone when the leg length exceeds two wavelengths. Thus, a longwire antenna five wavelengths long will have a gain of about 4 dB in each of its major lobes. If two such longwires are used in the vee configuration, you add another 6 dB and the bidirectional gain rises to 10 dB. A gain of 10 dB represents an effective transmitter power increase of 10 times. Thus, the 100 Watts rf output power from your Japanese transceiver is effectively raised to 1000 Watts. The estimated vee antenna power gains listed in Table 2 are conservative.

"Steerable" Vee Beam Design

The greatest advantage of the yagi antenna over a large wire array, such as the rhombic, curtain, or vee beam, is, of course, its compactness and the fact that it can be rotated over 360°. The fixed array is most useful for working into a given area, such as Europe or Australia, and is ideal for the retired or disabled ham who works the same station day after day. The two lobes of a vee beam having legs several wavelengths long are comparatively narrow, and the line of the apex bisector must be oriented accurately with respect to the distant station.

Antenna Lengths (Wavelengths)	Power Gain (dB)
1	2.10
2	5.50
3	7.00
4	8.00
5	8.75
6	9.50
7	10.25
8	10.75
9	11.25
10	11.70
11	12.00
12	12.25

Table 2. Estimated power gain of vee antennas with leg lengths of 1 to 12.

The array I'll describe here is designed so that the direction of the apex bisector may be shifted in azimuth by about 15° to 20°. This arrangement allows the center of the lobe (apex bisector) to be laid "dead on" the distant location. The rope and pulley arrangement also allows the apex angle to be adjusted accurately with a field-strength indicator to obtain optimum gain.

My W6TYH vee beam is suspended from three large oak trees that nature was kind enough to grow as the corners of an equilateral triangle about 120 feet on a side. It was decided to make each leg of the vee two wavelengths long. Referring to Table 1, a leg two wavelengths long is 91 feet, 4 inches, and the apex angle for a vee with two wavelength legs is 70°. The bidirectional gain is about 5.5 dB, about the same as that of a two-element yagi on a high tower.

To determine distance D between the ends of the two legs at the base of the vee (open end), the ratio of 0.5D to the leg length, L, equals the sine of the tilt angle, T. As shown in Table 1, the tilt angle is equal to one half the apex angle. Thus, for a vee array with a leg length of two wavelengths, the tilt angle will be 70°/2 or 35°. Proceed as follows:

sin T = 0.5 D/L

sin 35° = 0.574 = 0.5 D/91.3

Therefore, 0.5D = 0.574 x 91.3 = 52.4062 = 0.5D, then D = 52.4062 x 2 = 104.81 feet or 104 feet, 9 inches.

The dimension D for vee arrays with longer leg lengths is calculated in the same manner. This data is included in Table 2.

To orient your vee beam accurately so that the apex bisector points to the distant spot on the globe, you should lay out a true north/south reference line through the center of your antenna site. Later, in the section covering the adjustments of the array, I'll tell you how to lay out the reference line and use it to orient the antenna.

When I was setting up the W6TYH antenna, I discovered that the apex end of the proposed vee beam and one tree were on a line precisely east and west. To project the apex bisector line (lobe center) directly on Europe and Australia, the apex bisector should be oriented about 15° north of east and south of west, respectively. To do this, I decided to support the open end of the vee from a 1/4-inch nylon rope stretched between the two farthest (base) trees.

Currently, my array is oriented directly on Sydney, Australia, and is pulled up to a height of about 23 feet above the ground. I work into both Europe and the South Pacific with excellent signal strength reports. Later, I hope to add another vee section in a stacked configuration for still greater gain.

Very High-Gain Vee-Beam Design

The gain of a vee beam antenna system may be increased by any one or all of the following:

(1) By making each leg longer in wavelengths;

(2) by stacking two arrays, one above the other; and

(3) by placing another identical vee array in front of or behind the one and driving one array 90° out of phase with the other.

In the last case, the radiated pattern will be unidirectional and the gain will increase by 3 dB. The following comments apply particularly to methods 2 and 3.

First, concerning the stacked vees, the top vee must be at least one wavelength above ground (about 45 feet for 21.3 MHz), with the second vee placed directly under it. The spacing between the top and bottom vees is one half wavelength (free space), with the lower vee at least 23 feet above the ground for 21.3 MHz. The apexes of the two vees are connected to the two ends of a half-wavelength open-wire line made from two No. 14 copper wire conductors spaced about 4 inches on centers. The right leg end of the upper vee conductor must connect to the same open-wire conductor that is connected to the right leg end of the lower vee conductor. In other words, the upper and lower vees are operated in phase with each other.

Date	Minutes (+) or (-)
January	
6	(+) 6
16	(+) 10
February	
6	(+) 14
16	(+) 14
March	
6	(+) 12
16	(+) 9
April	
6	(+) 3
16	(0)
May	
6	(-) 3
16	(-) 4
June	
6	(-) 2
16	(0)
July	
6	(+) 4
16	(+) 6
August	
6	(+) 6
16	(+) 4
September	
6	(-) 1
16	(-) 5
October	
6	(-) 12
16	(-) 14
November	
6	(-) 16
16	(-) 15
December	
6	(-) 9
16	(-) 5

Notes: Step 1—Make longitudinal time correction first (see text); Step 2—From selected date, determine number of minutes seasonal time correction required (see text); Step 3—Add or subtract seasonal time correction (minutes in right-hand column) to or from longitudinal time correction; Step 4—Add total to local legal or official time (EST, CST, MST, or PST).

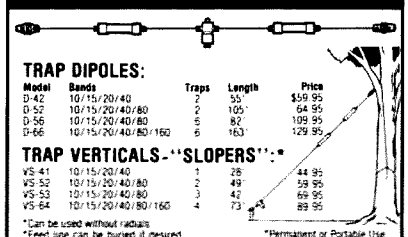
Table 3. Seasonal time-correction chart.

Materials	Cost
250 feet No. 14 plastic-covered electrical wire, copper, at .05 per foot	$12.50
Two 6" insulators; 1.00 each	$2.00
300 feet ¼" nylon rope; .80 per foot	$24.00
Three pulleys for ¼" rope; .90 each	$2.70
3 feet, ¼" copper tubing for L1; .40 per foot	$1.20
C1 from junk box (old BC radio tuning capacitor will be suitable)	
Miscellaneous	$1.00
	$43.40

The above cost is an estimate if everything is purchased. The W6TYH array actually cost less than $25 since some of the material was on hand.

Table 4.

MULTI BAND TRAP ANTENNAS



TRAP DIPOLES:

Model	Bands	Traps	Length	Price
D-42	10/15/20/40	2	55'	$59.95
D-52	10/15/20/40/80	2	105'	64.95
D-56	10/15/20/40/80	6	82'	109.95
D-66	10/15/20/40/80/160	6	163'	129.95

TRAP VERTICALS-"SLOPERS":*

VS-41	10/15/20/40	1	28'	44.95
VS-52	10/15/20/40/80	2	49'	59.95
VS-53	10/15/20/40/80	3	42'	69.95
VS-64	10/15/20/40/80/160	4	73'	89.95

*Can be used without radials
*Feed line can be buried if desired

**Permanent or Portable Use

ALL TRAP ANTENNAS are Ready to use - Factory assembled -Commercial Quality -Handle full power - Comes complete with: Deluxe Traps, Deluxe center connector, 14 ga Stranded CopperWeld ant. wire and End Insulators. Automatic Band Switching - Tunor usually never required - For all Transmitters, Receivers & Transceivers - For all class amateurs - One feedline works all bands - Instructions included - 10 day money back guarantee!

SINGLE BAND DIPOLES (Kit form):

Model	Band	Length	Price
D-15	15	27'	18.95
D-20	20	33'	19.95
D-40	40	66'	23.95
D-80	80/75	130'	25.95
D-160	160	260'	34.95

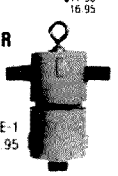
Includes assembly instructions, Deluxe center connector, 14 ga Stranded CopperWeld Antenna wire and End insulators

COAX CABLE: (includes PL-259 connector on each end)

Type	Length	With antenna purchase	Separately
RG-58	50'	$8.00	$11.95
RG-58	90'	12.00	16.95

DELUXE CENTER CONNECTOR

- NO RUST Brass Terminals
- NO Jumper Wires Used
- NO Soldering
- Built-in Lightning Arrestor
- With SO 239 Receptacle
- Handles Full Power
- Completely Sealed Weatherproof
- Easy Element Adjustments
- Commercial Quality



CE-1
$8.95

DELUXE ANTENNA TRAPS: Completely sealed & weatherproof -Solid brass terminals - Handles Full Power - NO jumpers - NO Soldering. Instructions included. For 4-band Dipole Ant. 40/20/15/10 $36.00/pr. For 5-band Dipole Ant. 80/40/20/15/10 $38.00/pr.



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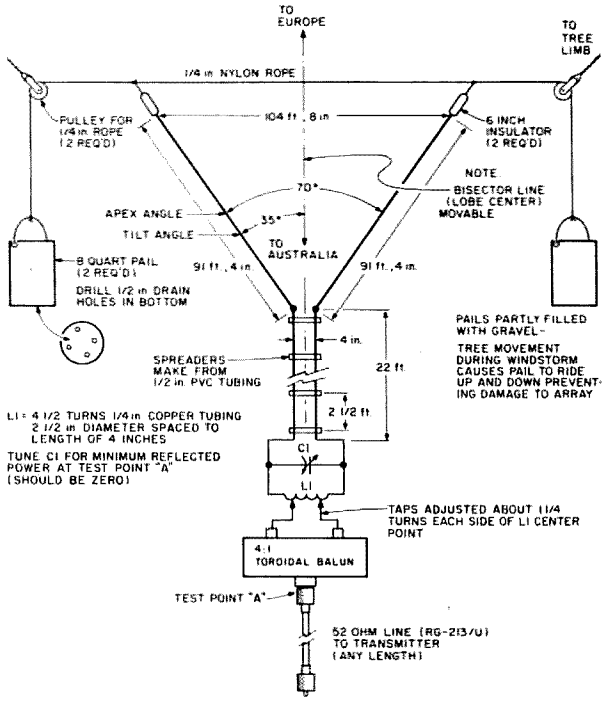


Fig. 1. W6TYH vee beam for 15 meters.

The interconnecting open-wire line is referred to as a phasing line. To ensure that the two sections of the array, upper and lower, are driven in phase and receive equal-amplitude rf currents, the feedpoint for the system should be located at the center of the open-wire phasing line, positioned a quarter wavelength away from the apex feedpoint of each vee section.

To the center feedpoint of the phasing line, connect another identical open-wire line but only one quarter-wavelength long. This quarter-wavelength line plus the quarter wavelength of line from the apex feedpoint of each vee section down to the phasing line feedpoint will be equal to a distance of one half a wavelength and will cause the open end of the second quarter-wavelength line to appear as a high-impedence point. To feed a high-impedance point on a line, you need a parallel-resonant tuned circuit. Such a circuit is useful for resonating the system and for matching the feedpoint to a 52-Ohm coaxial cable transmission line back to the transmitter.

Vee Beam Adjustments

The vee array, singly, stacked, or excited in quadrature, is virtually foolproof. If you follow the dimensions and instructions given here the array won't fail to perform with good results. For maximum performance, all dimensions and adjustments should be made as accurately as possible.

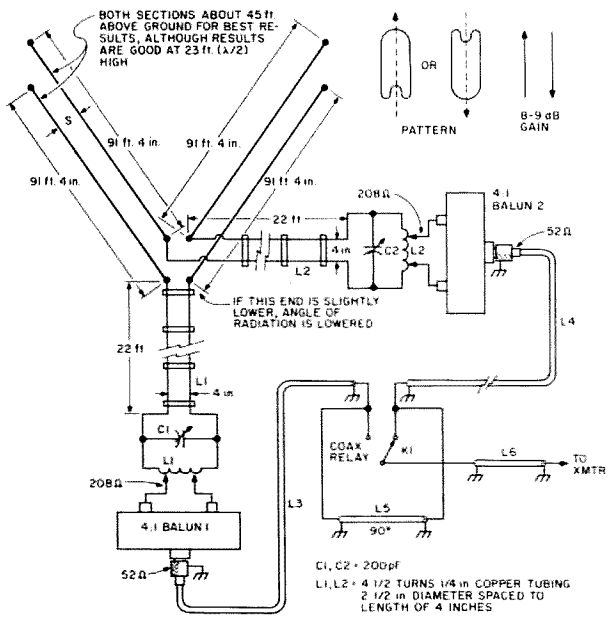
The exact leg lengths are not extremely critical for a given frequency; the exact lengths specified here have been pruned to allow you to use the array over a bandwidth of about 200 kHz without having to retune the coupling circuit at the antenna or change the loading at the transmitter. The longer the leg lengths, the less critical the adjustments with respect to a change in frequency.

Once the array has been installed, connect the two output terminals of the 4:1 impedence ratio toroidal balun transformer at points about one or two turns each side of the L1 center point. Connect an swr (reflected power) meter in series with the 52-Ohm line and the coaxial input terminal of the balun (Test Point A in Fig. 4). Set the meter selector switch on F (forward), and turn the indicator sensitivity control all the way off. From the transmitter, apply an unmodulated carrier signal of about 5 Watts or less, and of the correct frequency, to the 52-Ohm line. Adjust the swr meter sensitivity control until the indicator pointer reads exactly full-scale forward. Now, throw the meter selector switch to indicate reflected power (R). Quickly rotate C1 for the lowest meter indication ("null" or "dip"). If you can't bring the indicator pointer to zero, move the balun tap connections away from or closer to the center of L1.

When the tap connections are correct and the indicator pointer reads zero by adjustment of C1, the 52-Ohm line will be "matched" through the balun to the 208-Ohm balanced feedpoints on L1. At the transmitter, the line should "match" the transmitter 50-Ohm output impedence without having to use an antenna "tuner." The transmitter output circuit should load normally to the rated output power level.

Field Strength Adjustments

To adjust the array for maximum gain (field strength), I used a portable, battery-operated solid-state short-wave receiver. The General Electric Model 7-2990A or equivalent is ideal for this purpose. The GE receiver is equipped with a digital-readout frequency



Notes: (1) S = 0.25. L1-L2 = openwire line, #14 copper spaced, 4". *L1 must be exactly same length as L2.* (2) L3-L4 = RG-213/U or RG-8/U coaxial lines. *May be any length but must be exactly the same length.* (3) L5 = RG-213/U or RG-8/U. L = 162.36/f where f = frequency and L = feet. For 21.3 MHz, length of RG-8/U or RG-213/U = 7 feet, 7½ inches. (4) Unidirectional pattern may be switched in either of two directions along apex bisector line. Gain over dipole approximately 8–9 dB. (5) Adjust taps on L1 and L2 for zero reflected power at test point A. Adjust each section individually as per text and then recheck entire system in operation. Trim minor adjustments of C1 and C2 as required.

Fig. 2. Endfire vee beam for 15 meters.

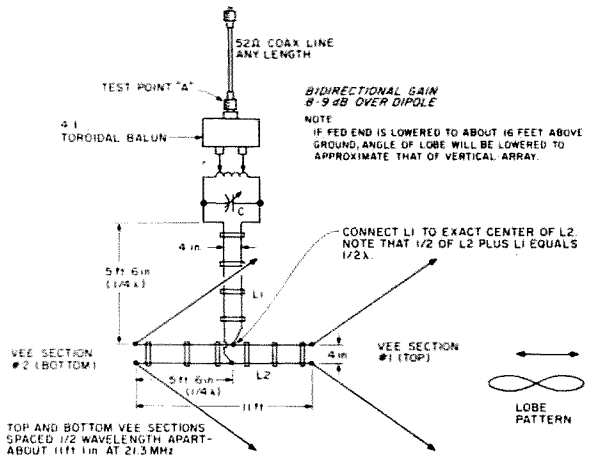


Fig. 3. Stacked vee beam array for 15 meters.

indicator, accurate to about 1 kHz, and a signal-level meter (not a calibrated S meter). In order to adjust the array for maximum field power, I placed the little receiver about a mile away from and directly in front of the antenna, and varied dimension D for maximum signal-level indication. The increase in the field strength was barely perceptible, but it was satisfying to know that the array was in optimum adjustment.

Vee Beam Unidirectional Operation

When two vee arrays are arranged one behind the other, spaced a quarter wavelength apart, and driven 90° out of phase, the pattern will be unidirectional with maximum radiation in the direction of the array with the lagging rf current. The directional characteristics will be "end fire," but the radiated lobe pattern will be much sharper than the pattern obtained from vertical-phased arrays. Although I haven't calculated or measured the pattern from a double-vee phased array, the rear of the pattern, along the apex bisector line, should be highly suppressed with the usual cardioid notch resulting in a high front-to-back ratio. The phasing control circuit shown can be used to reverse the direction of maximum radiation by 180°. The unidirectional gain of the phased vee system will be about 3 dB greater than that of a single bidirectional array. The directional system is controlled remotely by means of relays and miniature toggle switches.

Terminated Vee Antennas

To make a vee array unidirectional, each leg may be terminated at its far end with a non-inductive resistor of about 400 to 800 Ohms. The terminated-vee radiation pattern is practically unidirectional in the direction of the terminated ends. The terminating device should be capable of dissipating one-third of the rated transmitter rf power output. It may be made up by connecting a number of 2-Watt carbon resistors of suitable values for the termination.

In actual practice, the terminating resistor values are adjusted for minimum standing waves on the transmission line. It's usually necessary to try different values and repeat the procedure at different frequencies throughout the amateur band in order to obtain the optimum resistance value. An insulated counterpoise wire may be connected across the open end of the vee to act as a ground for the termination. The terminating resistor is connected from the end of the vee conductor to the ground wire. Do not connect the ground wire directly to the vee leg conductors.

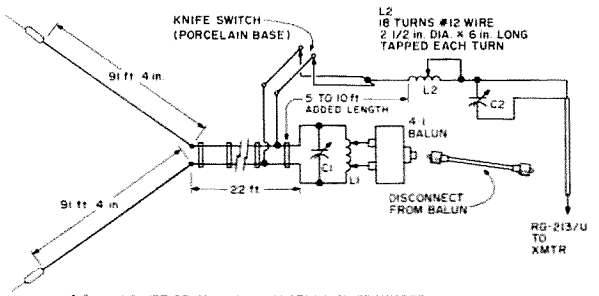
Orientation of Vee Beam Antenna

Radio waves travel from one point on the earth's surface to another by way of a great circle route. To produce the greatest signal strength at the distant receiving point, the front of the antenna field pattern must be aimed in the great circle direction of the receiver. The first step in the orientation procedure is to establish a true north/south reference line through the antenna site.

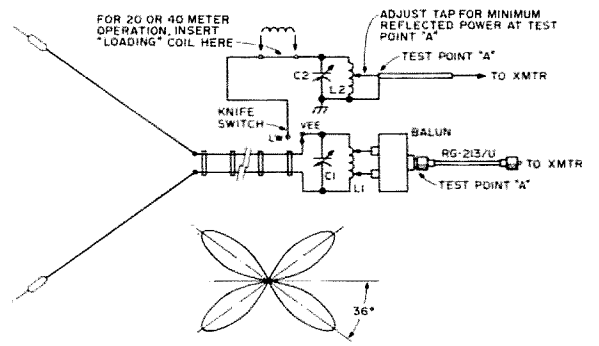
There are several methods that can be used to determine the direction of true north. If you have a good quality magnetic compass it will indicate the direction of the north magnetic pole. However, since the magnetic poles of the earth "drift" constantly, the compass indication must be corrected for any given time. You can usually obtain the amount of correction by calling your city or county surveyor's office or by contacting a civil engineering organization. For ages, the North Star has been used to determine the position of the north geographic pole. Today, however, due to air pollution, especially near large cities, it may be difficult to locate the North Star. There is another method—the use of the sun at true noon—that is very accurate and can be used on any day of the year when the sun shines.

At exactly noon (sun or standard time), at any place on earth, the sun bears due south in the Northern Hemisphere and due north in the Southern Hemisphere. Therefore, at high noon the shadow of a vertical pole or suspended vertical line is pointing due north in the Northern Hemisphere or due south in the Southern Hemisphere.

To precisely locate true north or true south, you must use a very accurate timepiece, preferably synchronized with time signals from WWV. The time indicated for noon must be corrected first from your antenna site location and second for the day on which the siting is accomplished. When these two corrections are applied, the resultant time is



"A"- USING VEE BEAM AS 1/2λ ANTENNA ON 75 METERS



"B"- USING ONE LEG AS 15 METER LONG WIRE FOR NON-DIRECTIONAL ANTENNA EACH OF FOUR LOBES HAS ABOUT 2 dB GAIN. ALSO OPERATES ON 20 OR 40 METERS USING LOADING COIL

Fig. 4.

exactly solar noon, and the shadow of a vertically suspended line will be in the exact north and south position.

To correct your standard time for your location, consult a globe or an atlas to determine the longitude of your antenna site. An accuracy of about 15 minutes of longitude will be sufficient. The time correction to be applied is equal to one minute of time for each 15 minutes of longitude, or 4 minutes of time for each degree of longitude. The amount of correction will be determined by the difference in longitude between your antenna site and the particular meridian of longitude on which your local standard time is based. In the U.S., local EST is based on the 75th (75°) meridian of longitude, local CST is based on the 90° meridian, local MST is based on the 105° meridian, and PST is based on the 120° meridian. The 120° meridian passes through Nevada, a few miles west of Reno. The W6TYH antenna site is located on the 121° meridian of longitude; I'll use that location as an example.

Standard times (EST, CST, MST, and PST) are legal or official times but are not necessarily solar or sun times. For example, on June 16th of any year, at 12:00 noon local standard time on any time-base meridian, the sun will be directly overhead and the local standard time and the solar time will be the same. However, for a site located west of the time-base meridian, true solar noon will occur at a time earlier than the legal or official time noon.

For example, W6TYH is located west of the PST time-base meridian (120°). Therefore, on June 16th of any year, true solar noon will occur at the W6TYH antenna site at exactly 12:04 p.m. PST, since I must add 4 minutes for each degree of longitude. If the antenna site had been located on the 119° meridian, east of the time-base meridian, I would have had to subtract 4 minutes, and true solar noon would have occurred at 11:56 a.m. PST (actually 12:56 MST, because the 119° meridian lies within the MST zone). This time correction is referred to as longitude time correction.

The orbit of the earth around the sun actually is not a circle but an ellipse. You must add a second correction because of the varying motion of the earth in its orbit with respect to the sun. The necessary corrections for various dates throughout the year are calculated and presented in Table 3. When the correction is preceded by a plus sign, the correction should be added to the local standard time. When the correction is preceded by a minus sign, the correction should be subtracted. This time correction is referred to as seasonal time correction.

To illustrate the use of both the longitude and seasonal time correction, let's assume that the date on which the observation is to be made is June 26th of any year. Referring to Table 3, the seasonal time correction for this date is found to be plus 2 minutes. Since you must add 4 minutes for longitudinal time correction and another 2 minutes for seasonal time correction (for a total of 6 minutes), the exact instant of true noon will occur at W6TYH on June 26 of any year at 12:06 pm PST. Note that all local times are standard and not daylight-saving time.

Now that the preliminaries have been taken care of and you have determined the exact time of true solar noon at your antenna site, you can use this information to lay out a true north and south reference line through your antenna site—from there you will be able to determine accurately great-circle path directions to any point on the earth. The accuracy with which you are able to predict the point on the globe where your antenna field will be maximum will depend largely on your skill in laying out the reference lines through your antenna site and on a great-circle map or globe.

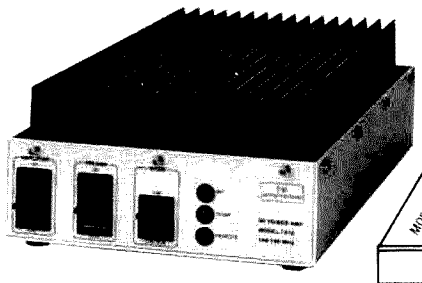
For the next step, you'll need a perfectly straight piece of pipe about 6 to 10 feet long. At the center of the antenna site, dig a hole about 10 or 12 inches deep. Stand the pipe in the hole and fill the hole with soil, tamping it to hold the pipe upright; check it with a carpenter's level to make sure that is it absolutely plumb (straight up and down). Tie a nylon cord around the pipe and stretch it out about 10 to 20 feet to the north. Watch the time, and at the exact instant of true noon, drive a rod or stake into the ground at the end of the pipe's shadow. Stretch the cord from the pipe to the top center of the stake. The cord is now stretched along your true north-south line.

If you have followed these instructions carefully, this line will point to the geographical poles of the earth with an accuracy within a few degrees. The line may be projected in each direction as far as you desire. Once established, a true north-south reference line is permanent and will always point to the geographical poles of the earth.

Since great-circle maps are not usually available for specific locations, use a globe for the next step. A low-cost student's globe made from pressed cardboard is best for this purpose. These globes have a center post at each geographical pole. Tie one end of a white thread around the north pole center post, dress it down over your location, wrap it around the south-pole center post, draw it taut and secure it in position. Stick a straight pin in the globe at your antenna location.

Stick another pin in the globe at the distant point to which you wish to transmit your signal. Stretch another thread between the two pins representing your antenna site and the distant receiving point. With a protractor, measure the angle of the bearing between the true north reference line (thread) and the line from your location to the distant receiver. Transfer the data obtained from the above measurements to the actual north-south reference line through your antenna site and determine the direction of the apex bisector line of your vee beam accordingly. ■

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MODEL [1]	FREQUENCY [2] (MHz)	OUTPUT POWER (W)	INPUT POWER (W)	PREAMP NF	PREAMP GAIN
0508	50-54	170	1	–	–
0508G	50-54	170	1	6	15
0510	50-54	170	10	–	–
0510G	50-54	170	10	6	15
1410	144-148	160	10	–	–
1410G	144-148	160	10	6	15
1412	144-148	160	30	–	–
1412G	144-148	160	30	6	15
2210	220-225	130	10	–	–
2210G	220-225	130	10	7	12
2212	220-225	130	30	–	–
2212G	220-225	130	30	7	12
4410	420-450 [1]	100	10	–	–
4410G	420-450 [1]	100	10	1.1	12
4412	420-450 [1]	100	30	–	–
4412G	420-450 [1]	100	30	1.1	12

1. Models with G suffix have GaAs FET preamps. Non-G suffix units have no preamp.
2. Covers full amateur band. Specify 10 MHz Bandwidth for 420-450 MHz Amplifier.

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The Match Maker

Everyone knows that antennas and transmitters should "match." But what exactly is that? And how is it achieved? Here are the answers.

Calvin McCarthy VE3LMP
98 Windsor Street
Thunder Bay, Ontario P7B 1T7
Canada

The need to find the "perfect match" is all-pervasive in life. The mechanic must fit a bolt to its matching nut. The worried mother strives to match her wonderful daughter with the perfect husband, and the radio amateur tries to create the perfect match between his exciter and amplifier, between his amplifier and his transmission line, and between his transmission line and antenna.

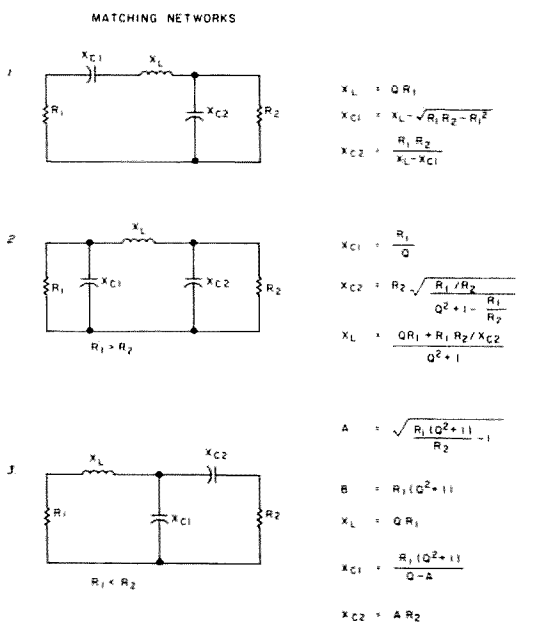


Fig. 1. These matching networks can be used to provide a match with maximum power transfer between unequal resistances.

What is all this concern about the perfect match? The mechanic's concern is obvious. None of us would suggest trying to fit a coarse-threaded bolt to a fine-threaded nut. Comments about the mother's concerns are best left to advice to the lovelorn, so we will discuss the concern of the amateur and leave mother to her fears.

Why Matching?

First we will discuss the reason for considering the matching problem. Efficiency of operation is always a concern. Why use more power than necessary to get the job done? There is a rule in electrical theory which says that you get the most energy into the job to be done (maximum power transfer) when the resistance of the source of the energy (signal generator) is equal to the resistance of the job to be done (load).

You can easily verify this with a few calculations. In Fig. 2 you see calculations done for a 10-volt generator with a resistance of 10 Ohms. As you look at the power-output figures, you will observe that the output power peaks at 2.5 Watts. Also observe that this occurs when the load resistance is equal to the generator resistance. If you are quick, something else will have crossed your mind. With maximum power transferred to the load, there is the same amount of power dissipated in the generator resistance. Only 50 percent of the power from the generator has reached the load. The other 50 percent has been lost as heat in the generator.

How is this important to us? If we are creating a signal in a generator, a vfo, a transmitting exciter, a kilowatt amplifier, or in a transmission line and we want the maximum power supplied to the load, we must make sure that the equipment which is supplying the energy has the same output resistance as the load resistance. For example, if your transceiver has an output resistance which looks like 50 Ohms, then to get maximum power transferred into the input of your kilowatt, the input resistance of the kilowatt must look like 50 Ohms as well.

Fig. 3 illustrates the idea. V_{gen} is the signal created by

GENERATOR RESISTANCE 10Ω
INPUT VOLTAGE 10V

POWER IN LOAD = $(I_{LOAD})^2 R_{LOAD} = \left(\frac{V_{IN}}{R_{GEN} + R_{LOAD}}\right)^2 R_L$

R_L Ω	P_{OUT} (WATTS)
1	.82
2	1.39
3	1.77
4	2.04
5	2.22
6	2.34
7	2.42
8	2.47
9	2.49
10	2.5 ← MAXIMUM POWER INTO THE LOAD
11	2.49
12	2.48
13	2.46
14	2.43
15	2.4
16	2.37
20	2.2
30	1.87
40	1.6
50	1.39
60	1.22
80	.99

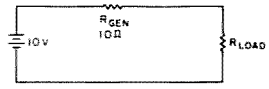


Fig. 2.

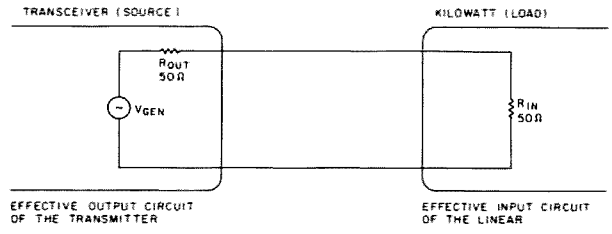


Fig. 3.

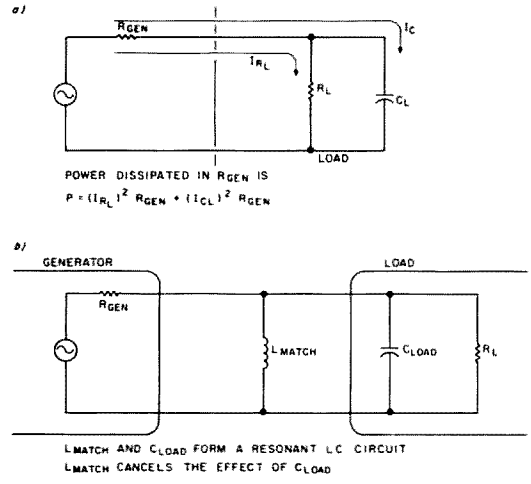


Fig. 4.

the final amplifier of the transceiver and R_{out} is the *equivalent resistance* of the same circuit. If you went into your final amplifier you would not find this as an actual resistor, but the circuitry which is there can look as though it were exactly a single resistance. Looking at the kilowatt input, the R_{in} is not an actual resistor either, but all the circuitry attached to the input looks like this single resistor if all you can do is measure it at the input terminal.

Another place where this is important is at your antenna. If your antenna terminals (the load) look like 75 Ohms to the signal generator (the output of your coaxial transmission line), then to get maximum power into the antenna the transmission line must look like 75 Ohms where it attaches to the antenna.

The perfect match we are thus looking for is a condition where the signal generator appears to have the same resistance as the load. This gives the desired maximum power transfer.

Loads With Inductors and Capacitors

If all circuits were resistive, then the matching problem would be reasonably simple. In radio-frequency circuits, however, we find capacitors and inductors as well. How do they affect our perfect match? An inductor or capacitor does not dissipate energy. All either of these does is absorb energy, then release it again later at a time when it is inconvenient.

Consider the loads of Fig. 4. They contain a resistor which will dissipate energy (do work) and a capacitor which accepts current from the generator and then puts it back into the system at a later time. This current, I_C, which flows through C must flow through R_{gen} as well, where R_{gen} dissipates energy ($I_C^2 R_{gen}$). This is energy lost without any work being seen for its loss. Remember how with just a resistive load energy was lost in the generator resistor as well, but at least some work was gained. This loss was acceptable but the losses created by the current through the capacitor are not acceptable.

The unacceptable loss of energy through the capacitor current (and the same thing would result if the capacitor were changed to an inductor) suggests that this reactive component should be removed from the circuit. This component may, however, be fixed in the circuit and not removable. Is a match possible with this situation? Yes, we can use our knowledge of resonant LC circuits to neutralize the effect of the reactive component.

If a capacitor, inductor, and resistor are combined to create a resonant circuit at the frequency where the reactance of the capacitor is equal to the reactance of the inductor (resonant frequency), the circuit will look to the generator as though this were only a resistive load. The current flowing in the capacitor would be cancelled by the current in the inductor and the only current flowing through the R_{gen} would be resistive current.

The circuit of (a) in Fig. 4 is not desirable for maximum power transfer, yet neither the generator box nor the load box can be modified. Consider now (b) in Fig. 4. A match has been created by attaching L_{match} in parallel with the load to cancel the effect of C_{load}. Now a condition where maximum power transfer is possible has been created.

This expands our condition for maximum power transfer to say that the generator resistance must be equal to the apparent load resistance and any reactive component in the generator must be matched by the opposite reactive component in the load ($2\pi fL = 1/2\pi fC$).

Different Output and Input Impedances

If this were all there is to matching, it would be an elementary problem. Life is never so simple, however. Matching involves providing a maximum power transfer from a generator of maybe 5 Ohms to a load of 50 Ohms. This is the problem of matching a power-transistor collector to a coaxial transmission line. To get the maximum power transfer out of the transistor, the transistor must be driving a load of 5 Ohms. But the load is 50 Ohms! To get maximum power transfer into the 50-Ohm load, the load should think it is being driven by a 50-Ohm generator. Our generator is only 5 Ohms! How are these two incompatible impedances reconciled?

The LC matching network

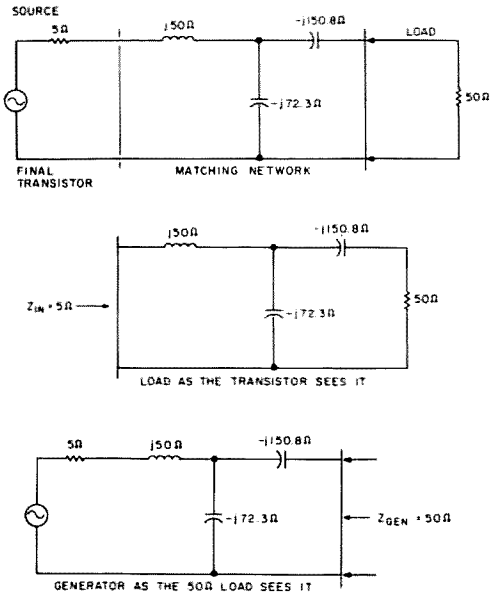


Fig. 5.

is able to reconcile these two impedances without a loss of energy in the conversion. Fig. 5 shows one possible matching network and its effect on the circuit. We will argue that the generator is the final transistor of a power amplifier. The LC network is the matching network. The load is a 50-Ohm coaxial cable feeding a 50-Ohm antenna. The transistor thinks its load is the combination of the matching network and the 50-Ohm coaxial cable. This apparent load looks like a 5-Ohm resistor at the frequency of operation. To the 50-Ohm transmission line, the matching network and transistor together appear to be its generator, and this combination looks like a 50-Ohm source resistance. The matching network has provided the impedance transformation so that the source (the transistor output) has the load it desires while the load (the 50-Ohm transmission line) has the generator it expects for maximum power transfer.

Your Place in All This

Can a radio amateur use this matching theory? You use it every time you tune your final, dipping the plate current and increasing the load coupling. Dipping the plate is effectively adding reactive impedance to the tuned circuit to cancel the opposite reactance which is in the circuit. Increasing the load coupling is bringing the effective load impedance to equal the effective source impedance.

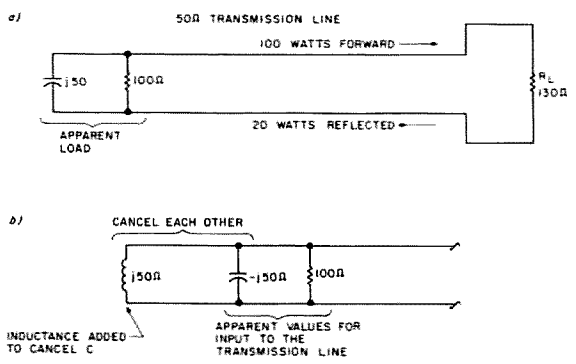


Fig. 6.

Transmission Lines and Matching

The problem of the perfect match also rears its head in transmission lines and antennas. It is desirable to get a maximum percentage of the generated power to the antenna.

Transmission lines such as a coaxial cable are very interesting components. If the cable is one thousand miles long, then its input terminals look like a resistor. A generator attached to this input appears to have a resistor for a load. Now if the cable is much shorter, more like the length we would use, but the far end of the cable is terminated in a resistor equal to the resistance which the very long cable looks like (the characteristic impedance of the line), then the input would still look like the same resistor. All energy put into the coax would travel down the coax and be used in the termination resistor (load).

But now the interesting phenomenon! If the load at the far end of the transmission line is not equal to the characteristic impedance of the line, all of the energy put into the input would travel down the transmission line but not all of it would be absorbed by the load at the far end. Some of the energy is reflected—sent back the way it came. Here we do not have maximum power transfer. All of the energy is not used in the load. Some of it travels back to the transmitter again, and now the transmission line becomes a signal generator with the reflected signal as the signal and the transmitter output device becoming the load. This returning energy would be used to heat the plate of the final or heat the transistor heat sink.

What if you have a high vswr on your transmission line and 20 Watts is sent back from the load which was sent 100 Watts by the transmitter? How can you protect your finals from this vswr of 2.6? Fig. 6 shows a possible situation which could cause this. The antenna with its impedance of 130 Ohms is connected to the 50-Ohm transmission line. For reasons explainable by transmission-line theory, we will say for our example that the input end of the transmission line looks like a resistor of 100 Ohms in parallel with a capacitor of 50-Ohm capacitive reactance. This near-end impedance is the load presented to your transmitter.

The transmitter connected to this point cannot tell the difference between the end of the coax and a real resistor and capacitor of our example value. Again we use a matching network as our solution. The effect of the capacitance can be cancelled by using an inductor to make a resonant circuit. Fig. 6 (b) shows this inductor added to make the input look like a resistor only. Now we have a resistive load which will accept power without causing extra final heating.

Tube Final Match

If your transmitter has a tube final, its pi network will be able to convert this 100-Ohm apparent resistance to the tube output impedance while adding the necessary inductance to cancel the capacitance. Fig. 7 shows a pi-network solution (network 2 in Fig. 1) which creates this match from our transmission line to a 1000-Ohm tube output. Notice that X_{C2} in Fig. 1 is made of two capacitors. One is the transmission line's apparent capacitance and the other is a real capacitor found in the matching network. Looking into the network where it attaches to the coax, the network would look like 100 Ohms of resistance in parallel with a 50-Ohm inductor. We have a good match to our coax input and it cancels the capacitance of the load.

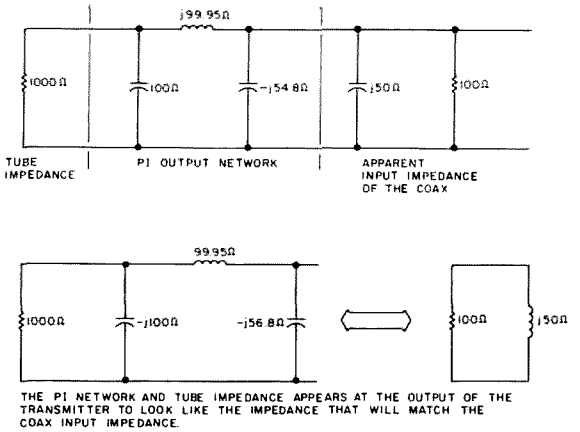


Fig. 7.

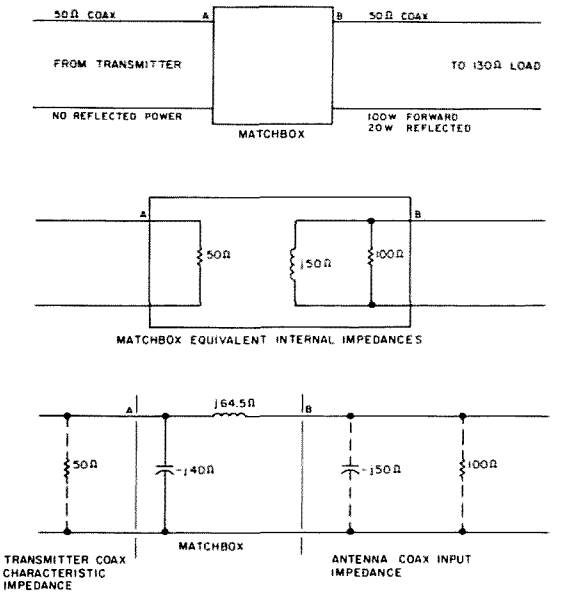


Fig. 8.

Transistor Final Match

For the modern amateur, this pi-network solution is not possible. Solid-state final transistors have an output impedance of maybe 1 Ohm and broadband transformers are used to transform this to an output impedance of 50 Ohms. The solid-state power amplifier must have a 50-Ohm load presented to its output by the transmission line. We will still consider our same problem and see how we can create a desired match with an antenna tuner or matchbox.

Fig. 8 shows the desired situation. The 50-Ohm coax from the transmitter must be terminated in a load at A which looks like 50 Ohms. This will make the transmitter see no reflected power. The 50-Ohm coax going to the antenna must see an impedance at the output of the matchbox which matches the 100-Ohm resistance in parallel with the 50-Ohm capacitance appearing at its input. This will give our desired maximum power transfer into the antenna transmission line.

An L network will provide the conditions to match both transmission lines effectively. If we could measure the impedance looking into port A (using an antenna noise bridge would work) we would be able to measure a 50-Ohm impedance and the transmitter would be able to put all its power into this resistive load. Looking into port B of the matchbox, we would be able to measure a 100-Ohm resistance in parallel with a 50-Ohm inductor, just the impedance we need for maximum power transfer into the antenna transmission-line impedance.

This example describes what you are doing when you adjust your antenna matching unit. The transmission line on the transmitter side of the matchbox has no reflected power in it so the transmitter is happy. The transmission line on the other side of the matchbox continues to have the same vswr as it did before but the matching network makes maximum power transfer possible from the transmitter into the antenna transmission line. Notice it has not made maximum power transfer possible into the antenna itself. To get this condition there would have to be something done to match the transmission line to the 130-Ohm antenna. Here the same principles of matching hold as we have already discussed. Get the driving impedance to look like a resistor equal to the load and cancel any reactive components in the circuit.

Conclusion

The "perfect match" in rf circuits is desirable and possible. Although you will make contacts without it, you will put less stress on your equipment and put more signal into the air if you study these principles and use them. Hopefully, this article has given an understanding of what happens when you tune your equipment and what causes the change in vswr as you adjust your transmatch. ■

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Antennas Should Be Heard, Not Seen

Ham radio meets interior decorating! KC3HW's 2m J-pole wins the prize for unobtrusiveness.

To anyone but a ham, an antenna is a blot on the landscape. Those not in the amateur fraternity fail to see the beautiful symmetry, the subtle technique, and the reliance upon natural laws to which our skywires conform. Perhaps if we were to pose as artists rather than amateurs and call our creations "wire sculptures," the neighbors would be more tolerant.

I ran into this no-antenna problem upon purchasing my first two-meter rig. In my case, this was a hand-held. I picked the hand-held because of its greater utility. A hand-held can double as a mobile or base rig, but mobile and base rigs don't make very good hand-helds. Unfortunately, the decision brought an unforeseen problem.

At home, the hand-held and rubber ducky combination had only enough output to access the two local repeaters. On simplex, it was good for three miles (in Pennsylvania we have these natural rf absorbers called hills). It didn't seem right to me to spend all that money for eight hundred channels and then confine myself to only two.

I tried a 5/8-wave whip, but that was awkward. It made the hand-held top-heavy and frequently hit the walls and ceiling.

An outside antenna was out of the question. Our house wore a "For Sale" sign, and my wife already had trimmed the antenna farm down to one obscure forty-meter dipole. She absolutely refused to hear about another antenna on the house.

This unhappy set of circumstances forced me to begin scanning the literature on indoor two-meter antennas. In doing so, I discovered something that most hams living in apartments and condominiums must already know. It's this. Few two-meter-antenna designs are intended for permanent indoor installation. Those that can be adapted are too ungainly for the average wife to accept as a long-term addition to the decor. Hasn't anyone developed a permanent indoor antenna for two that's aesthetically acceptable?

Not finding a ready-made answer, I developed the Hidden Hypo described below. If you're an apartment dweller looking for an antenna with substantial gain over a rubber ducky, then

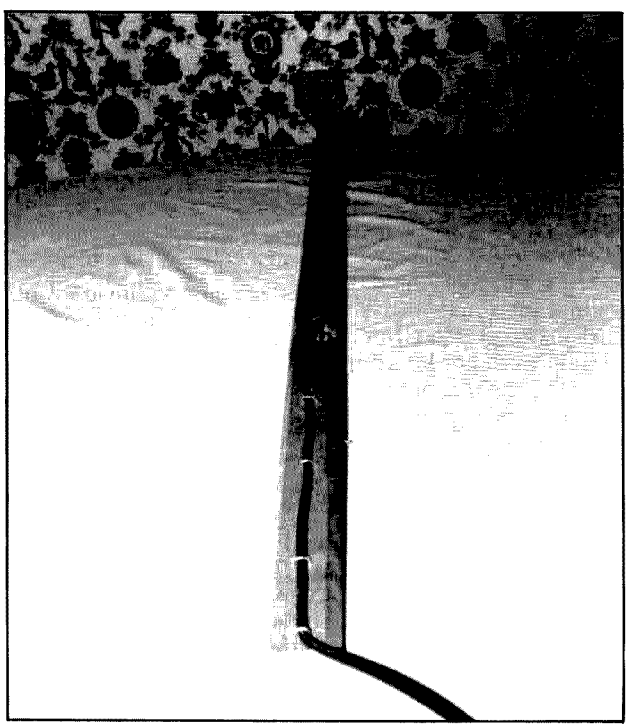


Photo A. The assembled Hidden Hypo (laid out on a bed) is mounted on the back of a piece of cove molding. Note that the coax is fastened to the back of the trim.

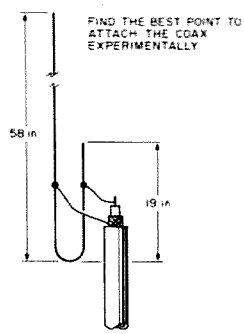


Fig. 1. The Hidden Hypo is really the well-known J-pole design. The spacing is not critical, but do keep the two legs parallel.

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scure the bottom portion of the trim. Even if the corner is bare, the opening is still not noticeable since it's located well below the normal line of sight.

A variation of this approach can be used if you wish to mount the Hidden Hypo on a flat wall. Here, you'll have to use one piece of panel trim. (This trim may go under a number of names—check Fig. 3 for its profile; it's technically called WP-982) and two pieces of parting stop. Both pieces or their equivalent should be available at your local home-center store.

Mount the trim pieces as shown in Fig. 3. Drive finishing nails in just far enough to hold the pieces together. Mount the Hidden Hypo behind the assembly just as behind the cove mould. Place the entire assembly on the wall and continue to drive the finish nails through the trim and into the wall.

Once the antenna is installed, the cove mould or alternative trim can be painted to match or complement the wall.

One last thought. What do you do if and when you decide to remove the Hidden Hypo?

No problem. Make another trip to your local home-center store and pick up a small can of vinyl spackling compound. It will fill any holes that you may have left. Follow the instructions on the can.

Conclusion

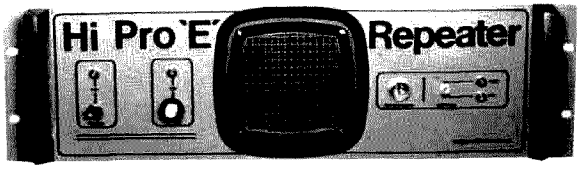
The Hidden Hypo is an easily-constructed antenna for two meters. It's vertically polarized and omnidirectional. Perhaps the nicest part is that it provides a reasonable alternative for those like me who can't put up an outside antenna. It's not a twelve-element beam at fifty feet, but it sure beats the whips and rubber duckies! ■

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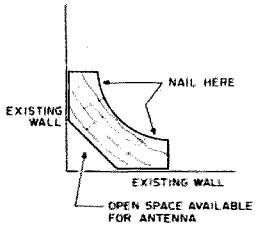


Fig. 2. Profile view of a piece of cove molding mounted in an inside corner. Note the open space available behind the molding.

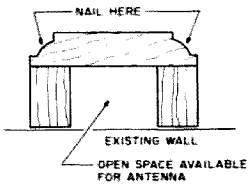


Fig. 3. Profile view of an alternative method used to mount the Hidden Hypo on a flat wall.

you'll find this interesting. If you're among those blessed with a good antenna, then the Hidden Hypo makes an excellent secondary antenna. Put it in the family room and monitor two meters while you sit and watch the game!

Design Considerations

King Solomon once said, "There's nothing new under the sun," and that's true for the Hidden Hypo as well. The basic configuration is the popular J-pole. However, while the design is well known, this antenna adds a couple of new wrinkles to it.

The first wrinkle is drastically reduced element spacing. Orthodox J-pole designs call for elements spaced three or more inches apart. The Hidden Hypo reduces this to one half inch.

At first thought, it may seem that bringing the elements this close together might create some undesirable interaction, but it doesn't. I experimented with spacings down to almost zero with good results. One half inch was chosen as a compromise. It was small enough to do the job yet wide enough to make construction easy.

The second wrinkle involves the method used to mount the antenna. The thin needle-like design (hence the name, Hypo) allows it to be hidden in places previously not possible.

Now, if this antenna were mounted on the back side of a piece of cove molding, the entire unit would fit in the corner of a room. Except for the coax leading to it, there would be no way of telling that an antenna was there.

For those not familiar with the construction industry, cove molding is most commonly used to trim a room where 12" × 12" ceiling tile has been installed. The trim (for our purposes) has three important features. First, it's nearly symmetrical, allowing it to be used as inside corner trim. Second, when installed, there's an open space behind it large enough to accommodate the antenna. Third, it's a commonly available material. The cove molding, along with the rest of the material used to construct this antenna, is available at most home-center stores and lumber yards.

Construction

The principal material used to construct the antenna is a seven-foot piece of 14-gauge insulated wire. I obtained mine by cutting it out of a piece of Romex electrical cable.

Pull the wire taut so that it's straight and then cut it to 77 inches. Measure up 19 inches and fold the wire back over on itself. You should end up with a U-shaped wire with one leg 19 inches and the other 58 inches.

From the fold, measure up 3-1/2 inches on each leg. Strip the insulation off each leg from this point to 7 inches above the fold. The antenna configuration is now complete and ready to be mounted onto the back side of the cove molding.

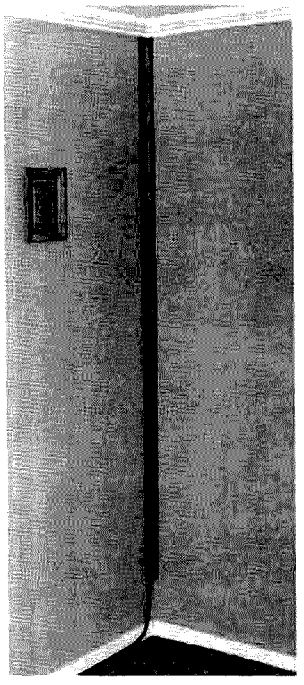


Photo B. Now you see it... The Hidden Hypo is mounted on the back of this piece of unpainted trim.

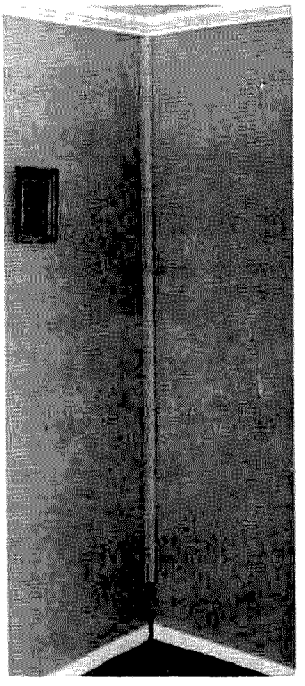


Photo C. Now you don't. The painted trim blends in with the rest of the room.

Lay the 58-inch leg on the cove molding and fasten the upper portion only. The section stripped of insulation and the 19-inch leg must remain free.

I used an Arrow T-50 staple gun and 9/16-inch staples to fasten the antenna. If you don't have access to a similar gun, you may choose to fasten the antenna using electrical wire brads.

Before completing the fastening process, carefully align the 19-inch leg so that it's parallel to the longer leg and spaced no more than 1/2 inch from it. If you get things too wide, the antenna will interfere when mounting the trim in the corner. It is *most* important to keep the spacing uniform. Don't let the elements assume a vee shape or belly apart. Nonuniform spacing will cause wild fluctuations of the swr meter when matching the coax to the antenna.

Next, expose the braid and inner conductor of the coax. Wrap but don't solder the braid to one leg and the inner conductor to the other leg. Apply power to the antenna and slide the coax up and down the uninsulated section of the antenna. At some point, the swr meter will dip. Solder the coax to the antenna at that point.

If you don't have a VHF swr meter available, you can solder the coax 5 inches above the fold. That will be close, but I recommend the meter method.

Finish fastening the antenna to the cove molding, being careful to preserve the alignment of the antenna elements. Use the 9/16-inch staples to fasten the coax to the cove molding, also.

Next, trim the molding so that it is an inch or two shorter than the length of the corner that it will fit in. Use this gap at the bottom to draw the feedline out from behind the molding.

At first, this might not seem aesthetically acceptable, but the situation isn't bad. In most cases there's something there to hide the opening. Corners naturally attract chairs, tables, and lamps which tend to ob-

Brent D. Harry
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White Bear Lake MN 55110

A Connoisseur's Microwave Converter

Brent Harry set out to build not the cheapest but the best downconverter possible. Serious microwave buffs will thank him.

This article describes the design and construction of a new microwave converter for use with either the 6-MHz MDS or the amateur-television allocation, centered at 2.153 and 2.314 GHz respectively. With the broad tuning range of its local oscillator, this converter could be used elsewhere, although the design was optimized for 2.153 GHz.

Since there are so many pre-built units, kits, and plans already available, why another? This converter's performance is very respectable, and its design offers other advantages such as high reliability and simple construction for those who prefer to build their own; however, I obtain these results at the cost of high-quality components. For example, both the high-gain input amplifier and high-stability reflection oscillator use high-performance H-P HXTR-2102 microwave transistors, $31.00 each, wholesale. Fortunately, the other components are much less expensive.

I conceded the necessity of expensive microwave transistors only after building many subsections and complete models with inexpensive ones. I also built models with more expensive low-noise gallium arsenide MOSFET input amplifiers (which are nearly mandatory at the 22,000-mile geosynchronous satellite distance), but biasing is more difficult and they did not provide a noticeable improvement in reception quality at the relatively trivial distances involved here, so I chose the lower-cost bipolar devices.

All microwave circuitry was designed with the modern scattering-parameter approach, facilitated with an H-P S-parameter test set, 8566A spectrum analyzer, microwave frequency counter, test ovens, etc.

Some of the features are: easy construction and stan-

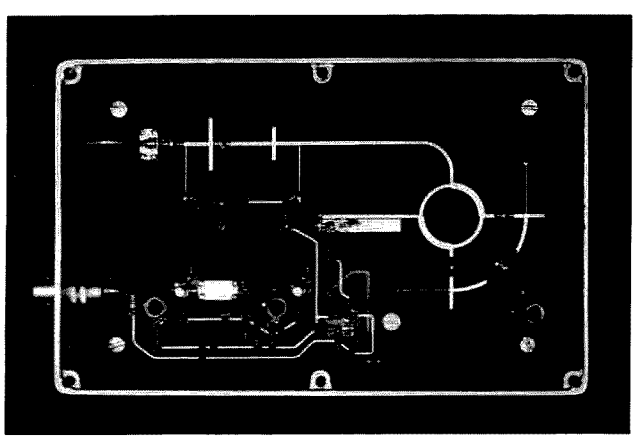


Photo A. This is what the circuit board looks like after being inserted.

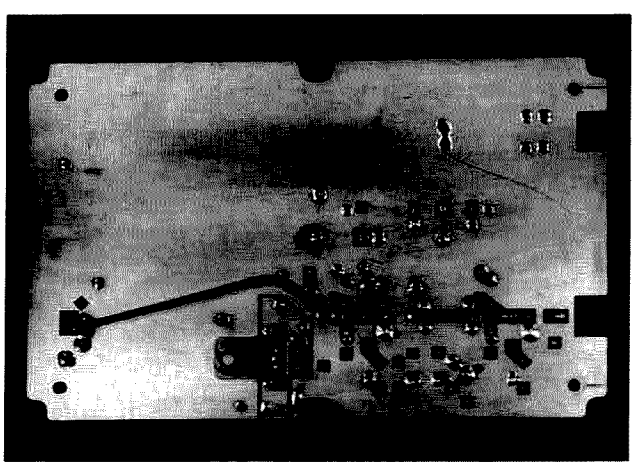


Photo B. The ground-plane side of the circuit board.

dardized performance with a double-sided etched board requiring no hand wiring, an input amplifier, a high-stability local oscillator, impedance matching for all microwave circuitry, an on-board regulator so that the variable tuning voltage affects only the local oscillator, and appropriate microwave-input connectors. All critical microwave tuning is predetermined by etched microstrip transmission-line segments.

The circuit board stands on ¼-inch spacers in a die-cast-aluminum case with a tight flange lid; the case is easily sealed with silicone rubber at the lid and the bases of the spacers if the correct rubber-gasketed connectors are used.

I taped a just-baked desiccant capsule (humidity absorbent) inside the cover immediately before sealing the case to prevent water or ice formation at cold temperatures. I used the indicating type which changes from blue to pink when it has absorbed its limit of water vapor. The photographed units were finished with almond-color epoxy spray paint. A light anodized finish would be more durable, although bare aluminum would be fine.

Of course, I don't claim originality for several aspects of this system, such as the use of the single downlead to supply dc power to the converter, dual-gate MOSFETs in the output amplifier, a parabolic dish antenna with a can feedhorn, or a commonly used hybrid junction (or "rat-race") mixer. I chose the circular form of this ring over the more common square form because the boundaries are more clearly defined. My earlier designs used a different ring with a differential output, driving a differential-input wideband IC amplifier; I finally accepted the present form as superior.

What about performance? Let me first say that I am wary of advertised high performance at low cost, especially when I see formed plastic. Since gain is an effective eye-catcher, insertion gain of the converter itself tends to be forsaken for system gain of the converter/antenna combination, especially when a reasonable-size parabolic dish can provide over 30-dB gain (measured with respect to a dipole). Of course, there is more to consider than gain, as noted ahead in the input amplifier section. Oscillator stability is one other measure of performance which is rarely advertised, and which I refuse to compromise.

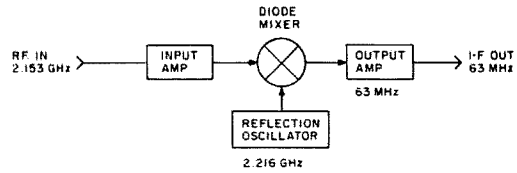


Fig. 1. System block diagram.

With a −70-dBm input at 2.153 GHz, the converter insertion gain is 38.0 dB with its output tuned to channel 3, centered at 63 MHz. An adjacent channel could be used instead. One could expect higher gain in actual use, driving a 75-Ohm television input instead of a 50-Ohm spectrum analyzer. Note that −70 dBm represents only 0.0001 microwatts since the 0-dBm reference is 1 mW into 50 Ohms; with 38.0-dB gain, the output would be 0.631 microwatts. I chose −70 dBm since it was slightly above the spectrum analyzer's threshold.

At 2.216 GHz, the off-to-on oscillator drift at room temperature is 0.3 MHz, indicating a stability of better than 0.014%, and drift over the temperature range −30° C to 60° C (−22° F to 140° F) is under 1.3 MHz, indicating a stability of

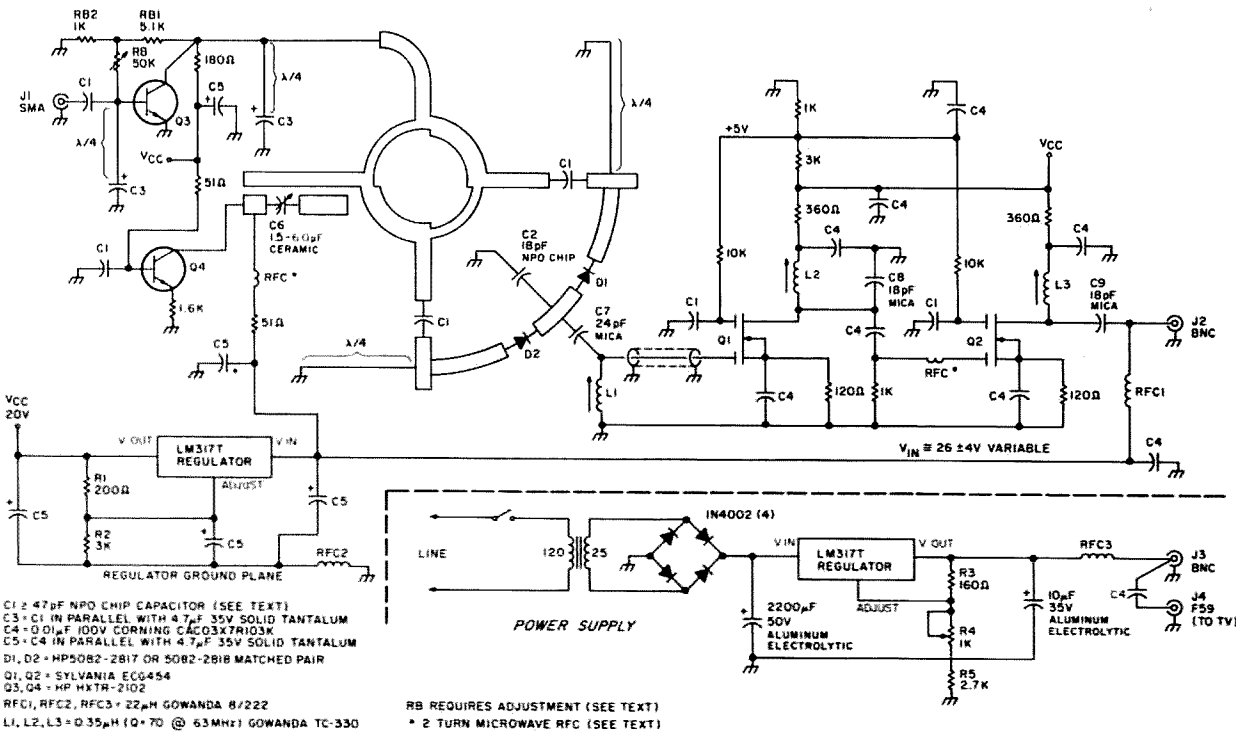


Fig. 2. Complete converter schematic.

better than 0.06%! I chose this temperature range since it should include any temperature seen in actual use.

Note: To achieve my measured gain and stability, it is essential to use high-quality (expensive) NPO chip capacitors which are qualified at 2 GHz. I've measured much higher drifts and lower gains while experimenting with other chip capacitors. The most important chip capacitors are at the base of the local oscillator and at the mixer, so at least those should be high quality. Expect to pay $5.00 to $10.00 apiece for appropriate capacitors.

I developed this project while living in Redondo Beach, California. This was a flat, indirect-signal location 32 miles from the transmitter in the LA area. I would have needed a tower for line-of-sight reception, so I used a 24-inch parabolic dish mounted on a camera tripod at ground level on the lawn. I could receive a fair (snowy but watchable) image in several directions because of reflections, but I had to aim at either the telephone lines or a large tree down the street in order to receive a good picture (one with easily-readable fine print). At this poor signal location, I could receive a fair picture even without the dish, or sometimes (depending on atmospheric conditions) a very poor one from inside the house, through the wall.

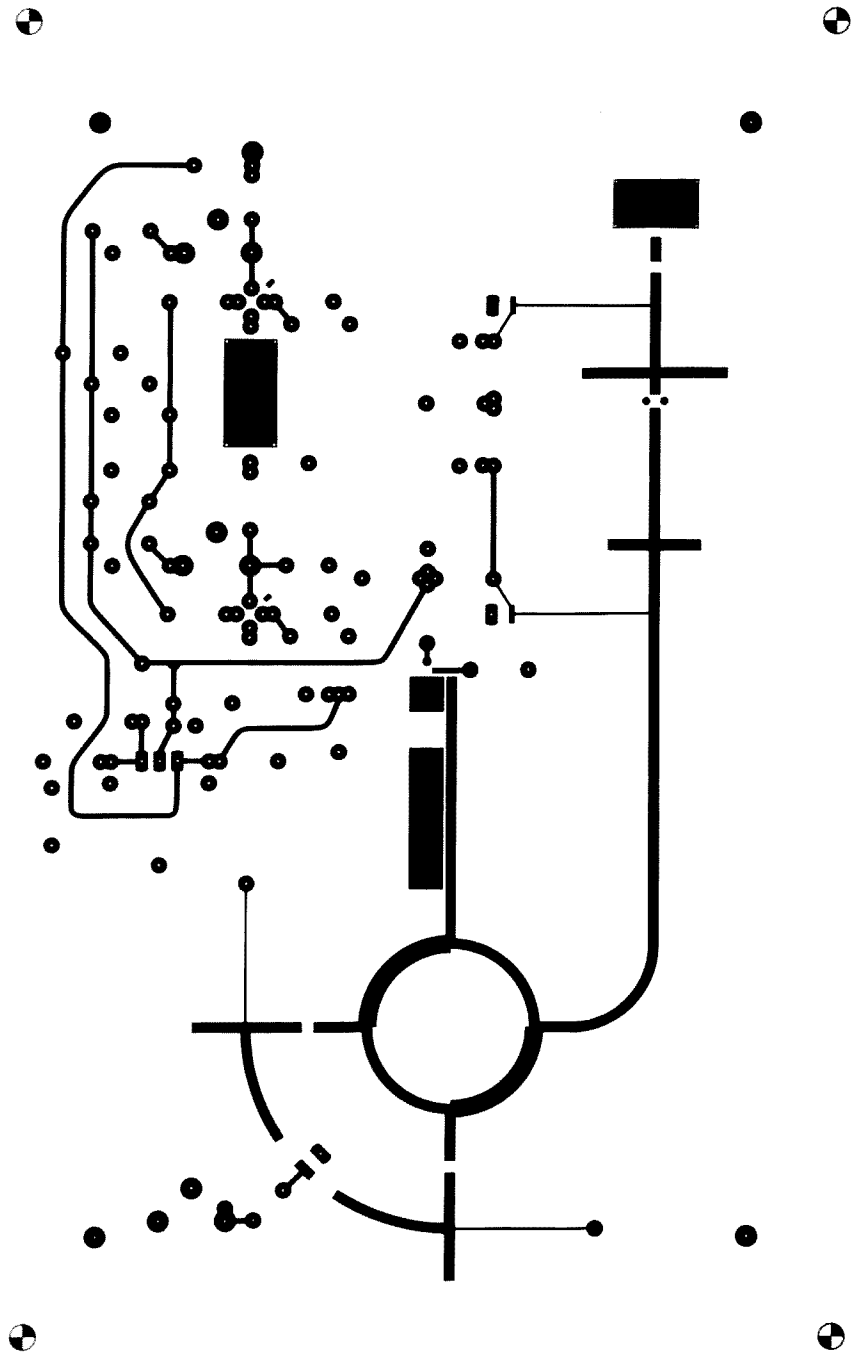


Fig. 3. Circuit board, component side.

Aren't microwave signals strictly line-of-sight and severely attenuated by obstacles? Yes, and that is an indication of this converter's sensitivity. I've tested this setup at other locations: It produced an excellent picture at a good line-of-sight location 21 miles from the transmitter, and a fair one at a partially tree-blocked location 65 miles from the transmitter. Doubling a given parabolic dish's diameter will quadruple the received signal power.

The block diagram and schematic diagram of the system are shown in Figs. 1 and 2, respectively. Photos A and B are views of both sides of the completed circuit board to aid in parts placement. Figs. 3 and 4 are illustrations of the front and rear sides of the etched board.

I did the artwork on a 4× scale for the sake of precision. For those who prefer to etch their own, let me stress that as well as accurate alignment, the correct circuit board material and thickness are essential since both affect the various microstrip transmission-line impedances. The material is NEMA type-FR-4 flame-resistant glass-epoxy, with a relative permittivity (dielectric constant) of 4.5 at 1 MHz. The required thickness is 0.031 inches. The board should be electroless-plated with gold or silver after etching, since bare copper deteriorates.

As well as supporting the circuit board, the aluminum spacers in each corner also electrically connect the ground plane to the aluminum case. Therefore, the spacers are mounted to the case with screws and no protective spray or other insulator should be used; do not glue-mount the spacers.

To locate the holes, I taped two-sided adhesive tape in the bottom of the case, placed the circuit board with screwed-on spacers into the case so that the spacers stuck to the tape, then unscrewed the screws from the spacers. When the circuit board was lifted out, the spacers were still stuck to the tape in their necessary positions. I had only to outline each spacer with a pencil before removing it. If the box has been totally anodized, be sure to sand the areas where the spacers and connectors make contact with the case.

Since the dimensions of the aluminum case are large with respect to the input wavelength but very small with respect to the output wavelength, the output BNC connector can use the case for its ground connection, although the input SMA connector cannot. That is why there is a ground pad for the input microwave connection. Short pieces of bare 26-AWG wire are used to connect each corner of both square ground pads to the ground plane, as well as the ground side of the 18-pF mixer-diode chip capacitor, and the ends of the four thin quarter-wave bias stubs. The two mixer stubs are terminated with a dc ground, but the two input amplifier stubs are terminated with a chip capacitor to ground.

As shown in Photo B, the only components on the ground-plane side of the circuit board are: chip capacitors to ground at the base of the local oscillator and gate 2 of both MOSFETs; the voltage regulator, insulated from the ground plane with a mica washer and nylon screw; a short piece of 50-Ohm semi-rigid coaxial tubing used to connect the output of the mixer resonator to gate 1 of the first MOSFET; and a noncritical 2-turn microwave choke, wrapped on a 5/32-inch drill bit at the input of the second MOSFET to prevent it from becoming a microwave oscillator.

The two emitter leads of the local oscillator transistor are trimmed down to about 2 mm long before the base lead is gently bent to go through the board at a right angle. The two pads for the oscillator's emitter and base resistors are intentionally undrilled so that the ground plane is continuous in the vicinity of the oscillator's base lead, which is grounded with a chip capacitor on the ground-plane side. The input amplifier's two emitter leads are similarly bent to go through the board, but are soldered directly to the ground plane.

Another noncritical 2-turn microwave choke, wrapped on a 5/32-inch drill bit, is formed as an integral part of the oscillator's collector resistor. Be careful to correctly identify the collector terminal of each microwave transistor (cut at an angle). The separate regulator ground

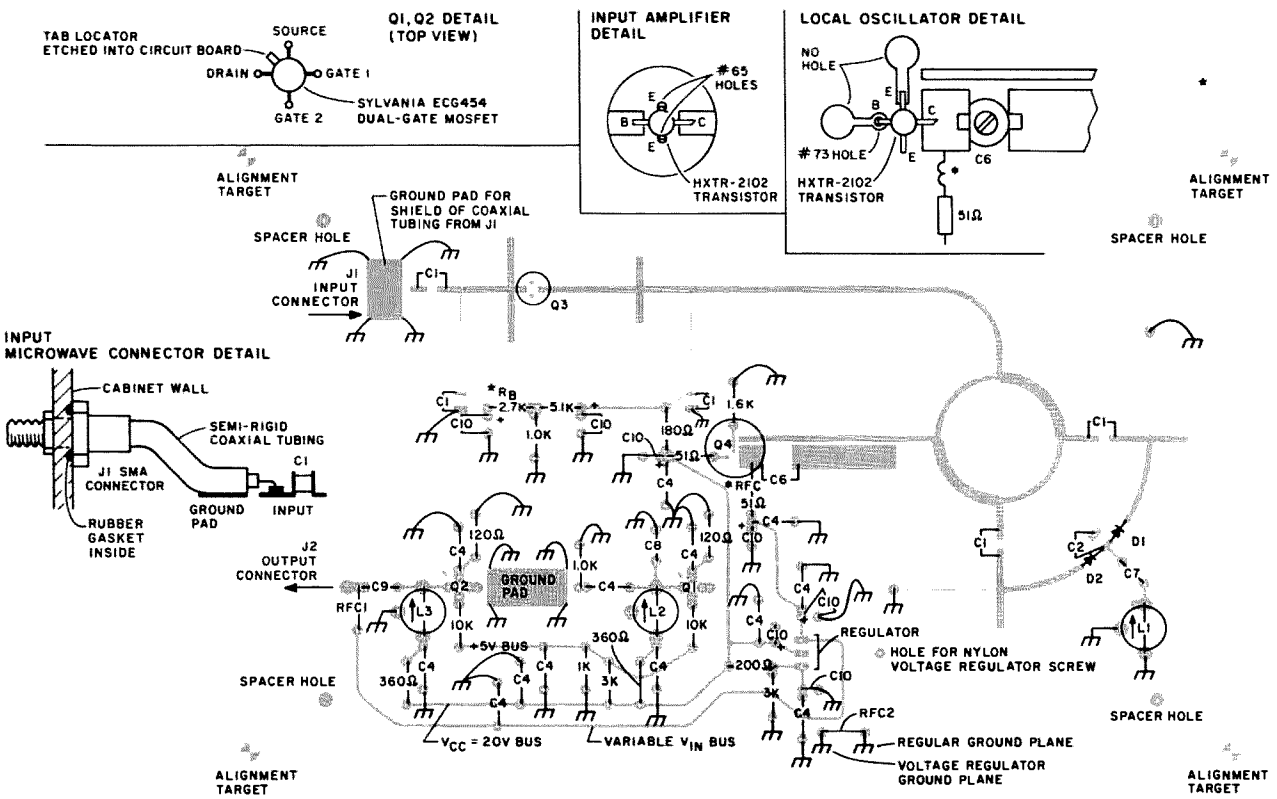


*Fig. 4. Parts placement, component side. Hole sizes: #69 drill bit except as otherwise noted: regulator (3 holes): #62; L1, L2, L3 (9 holes): #51; regulator and spacers (5 holes): #27; emitter leads of Q3 (2 holes): #65—locate centers with #80; base of Q4, 8 ground-pad corners, ground side of C2, and 4 ends of thin bias feed stubs (14 holes): #73. C1≥47-pF chip; C2=18-pF chip; C4=0.01-uF ceramic; C7=24-pF mica; C8, C9=18-pF mica. ★R_B is adjusted as explained in text. 2.7k is the initial value to start from. * 2-turn microwave rfc as explained in text.*

plane and solid tantalum capacitors are necessary because of the noise-generating regulator. Other types will not provide proper bypassing. The two ground planes are connected with a molded choke. Once the circuit board has been completed and screwed down on the spacers, the input and output connectors are soldered, and the converter is ready for tune-up.

Power Supply

The power-supply circuit of Fig. 2 is simple and noncritical, so I haven't illustrated the physical construction. Mine is built in an inexpensive cabinet with rubber feet, using terminal-strip hand wiring. The two connectors should be adjacent to each other with a good shared case ground. The supply provides approximately 26 V ±4 V to the converter, producing ample tuning range. One possible modification would be the addition of an antenna switch.

Mixer

The mixer has two inputs: the amplified input signal and the local-oscillator signal. The hybrid junction ring which couples these two inputs to the mixer diodes has four functions: (1) It isolates the signals from each other, (2) it provides a 50-Ohm load for each signal, (3) it allows each signal to divide equally in power between the two output arms (each diode receives two signals with respect to ground; the common connection of the two diodes looks like ground at microwave frequencies), and (4) it provides the proper positional phase relationships for these microwave input signals so that the mixer diode outputs reinforce each other.

A Smith Chart rotation and stub tuner transforms each diode's impedance to 50 Ohms so that the ring will operate properly and maximum power transfer will occur. This is why the mixer diodes are not connected directly to the output arms of the ring, as could be done if the diodes themselves were 50 Ohms. Unmatched designs do this, hoping to achieve 50 Ohms by driving 1 mA or more of noise-producing dc bias through the diodes. The correct method is to measure diode impedance at a particular absorbed (not incident) power, construct an appropriate matching network to transform that impedance to 50 Ohms, then adjust the local oscillator to provide the required absorbed power.

One very convenient method of monitoring absorbed power is to measure the "self-bias," which is the average rectified current driven by the local oscillator. To maximize mixer conversion efficiency, I chose 3-mA self-bias. My earlier models did use a small amount of dc bias, but this did not improve conversion efficiency whatsoever (which is not

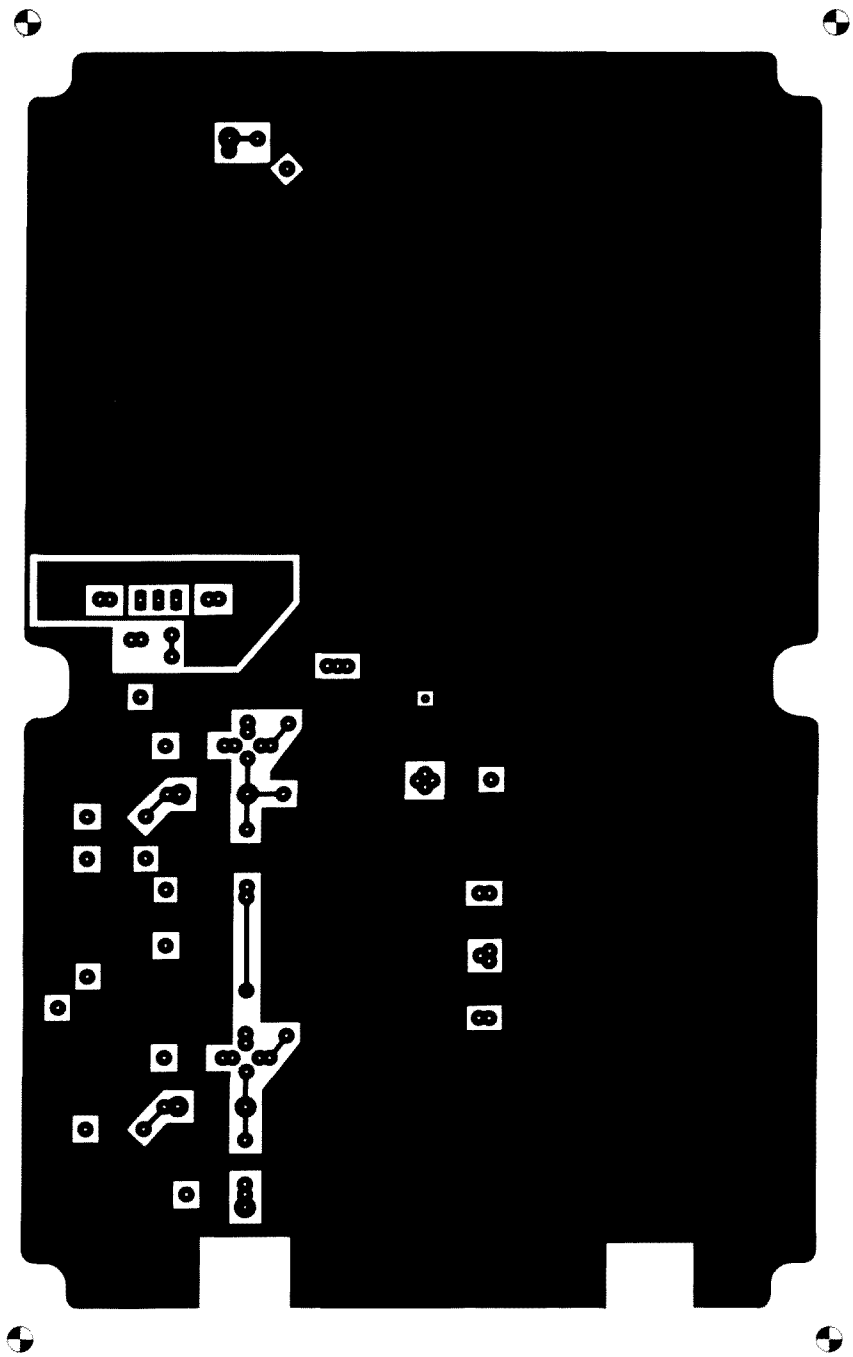


Fig. 5. Circuit board, ground-plane side.

true of all mixers). This mixer uses H-P 5082-2817 Schottky diodes, intended for low-noise, high-sensitivity mixing at 2 GHz. Using other mixer diodes would of course ruin the matching. If desired, the self-bias can be measured by cutting one of the bias stubs near its dc ground end, inserting a chip capacitor, and connecting a milliammeter across it (yes, current is made to flow from dc ground through two diodes, back to dc ground). The chip capacitor must be replaced with a short when finished to complete the dc return path. The diodes must be connected in series (either direction) for a dc path to exist.

Local Oscillator

The tuning range of this oscillator is approximately 1.8 to 2.4 GHz with the power supply set at mid-range. Because of the unusually large emitter resistor and emitter-resistor voltage (large dc negative feedback), the dc operating point of this transistor is held very constant over wide variation of the temperature-sensitive dc beta and V_{be}. This and the mode of oscillation produces the high stability already mentioned.

As stated earlier, this is a reflection oscillator. The frequency of oscillation is not determined by a feedback network; there is no feedback. The base is grounded with a chip capacitor and the collector serves as both the input and output. Looking into the collector, there is a range of frequencies over which the reflection coefficient is greater than one, indicating negative resistance. When attached to a resonant circuit with the correct reflection coefficient (in this case, a series-tuned microstrip segment), the transistor oscillates. The oscillator is capable of a much higher power output, but its bias network should not be modified since its power output affects the mixer-diode impedance for which the matching network was designed.

Input Amplifier

High output amplification will do nothing to better a system with a poor noise figure; however, high input amplification can cut a system noise figure in half while doubling system gain. System gain is the sum of stage gains in dB, but a system noise figure is more involved:

$F_{system} = F_1 + (F_2 - 1)/G_1 + (F_3 - 1)/G_1G_2 + (F_4 - 1)/G_1G_2G_3 + \ldots$

where F and G are stage noise figures and gains (power ratios, not dB).

An input amplifier is beneficial in terms of noise figures as well as in terms of sensitivity, gain, and oscillator-antenna isolation. There are many different criteria to choose among in microwave-amplifier design. This one uses narrow-band matching to achieve maximum power transfer into the 50-Ohm load while providing a 50-Ohm-input impedance. One alternative approach, designing the input amplifier for minimum noise figure instead, would have reduced the gain, possibly increased the system noise figure, and required precise antenna matching.

The input amplifier's S-parameters which were used to design its matching stubs are sensitive to changes in the dc bias. In

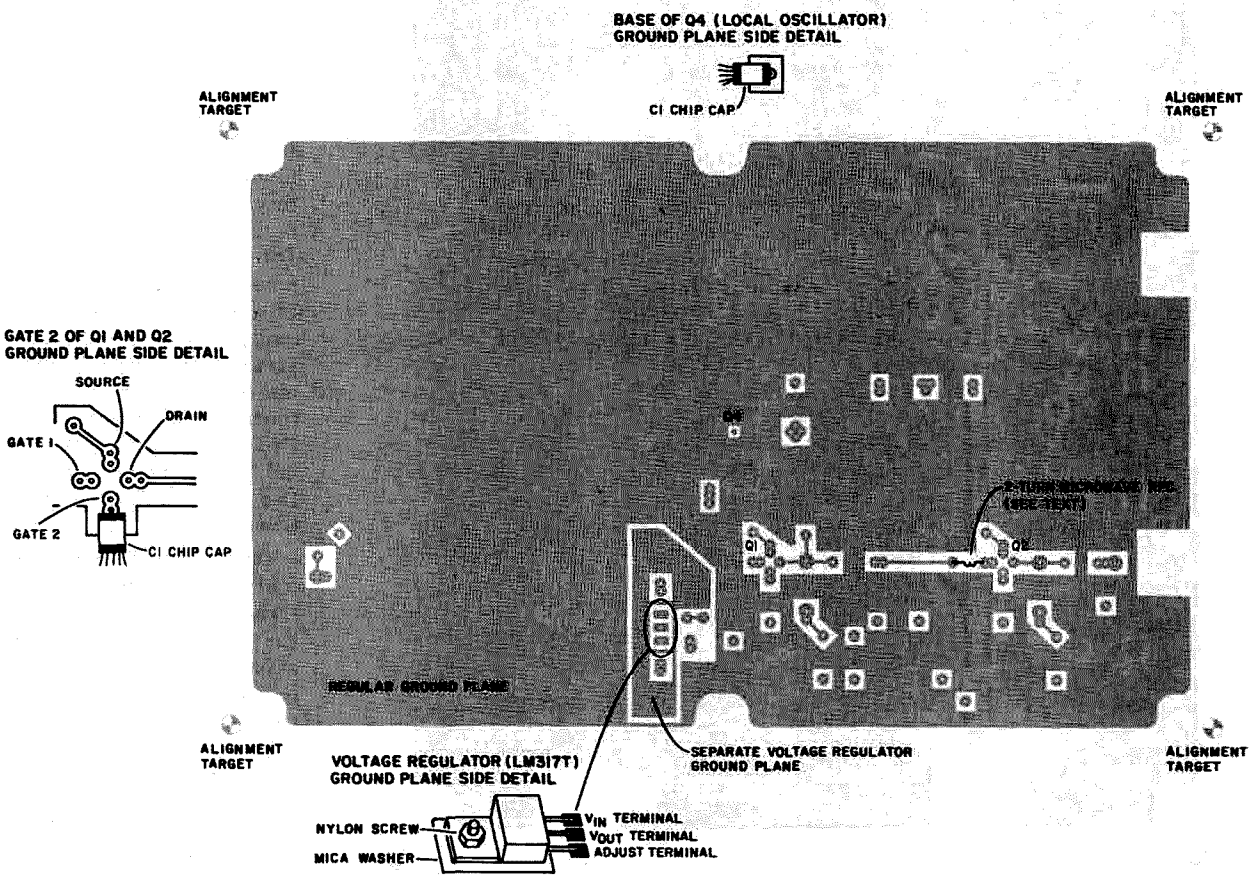


Fig. 6. Parts placement, ground-plane side.

Parts List

- 2 Microwave transistors: Hewlett-Packard HXTR-2102
- 2 Schottky mixer diodes: Hewlett-Packard 5082-2817
- 2 Dual-gate MOSFETs: Sylvania ECG-454 or similar
- 2 LM317T voltage regulators
- 3 .28- to .42-uH slug-tuned inductors (Q = 70 @ .35 uH & 63 MHz): Gowanda Electronics TC-330 or similar
- 3 22-uH molded chokes: Gowanda Electronics 8/222 or similar
- 2 Gold-plated female SMA connectors with rubber gasket, for 0.085" semi-rigid tubing: Amphenol 901-9210-2
- 2 Gold-plated male SMA connectors for RG-316/U coax cable: Omni-Spectra OSM 601-3
- 1 Female BNC bulkhead connector with rubber gasket: Amphenol 31-102 or similar
- 1 Female BNC bulkhead connector: Amphenol 31-221 or similar
- 2 Male BNC connectors for RG-59/U coax cable: Radio Shack 278-104 or similar
- 2 F-59 connectors for RG-59/U coax cable: Radio Shack 278-211 or similar
- 1 F-61 connector: Radio Shack 278-212 or similar
- 6" 0.085"-diameter, 50-Ohm semi-rigid coaxial tubing (copper-jacket tubing)
- 3' RG-316/U 50-Ohm coax cable
  RG-59/U 75-Ohm coax cable for downlead and connection to TV (under 3-dB loss per 100 feet at 63 MHz)
- 8 47-pF (or larger) NPO ceramic or porcelain chip caps (not critical; 18 pF will work) such as Union Carbide
- 1 18-pF NPO ceramic or porcelain chip cap such as Union Carbide
- 1 18-pF mica cap: Cornell-Dubilier CD10-CD180J03 or similar
- 1 24-pF mica cap: Cornell-Dubilier CD10-ED240J03 or similar
- 1 1.5-to-6.0-pF microminiature ceramic trimmer such as Erie* (range not critical; e.g., 2.0 to 10 pF would work)
- 14 0.01-uF miniature ceramic caps: Corning CACO3X7R103K or similar
- 7 4.7-uF, 35-V aluminum electrolytic cap
- 1 10-uF, 35-V aluminum electrolytic cap
- 1 2200-uF, 50-V aluminum electrolytic cap: Digi-Key 2200/50A or similar
- 1 1k linear potentiometer

¼-Watt, 5% carbon composition resistors (film should work)

- 2 51-Ohm
- 2 120-Ohm
- 1 160-Ohm
- 1 180-Ohm
- 1 200-Ohm
- 2 360-Ohm
- 3 1k-Ohm
- 1 1.6k-Ohm
- 2 2.7k-Ohm
- 2 3k-Ohm
- 2 10k-Ohm
- 1 5.1k-Ohm
- 4 1N4002 or similar rectifier diodes or molded bridge
- 1 25-V power transformer: Radio Shack 273-1512 or similar (the converter draws 57 mA: a light-duty transformer could be used instead)
- 1 Power-supply cabinet: Radio Shack 270-252 or similar
- 1 7" x 5" x 2" diecast-aluminum case with flange lid: Bud CU-247

*Typical potentiometer: Bourns, part #3262W, hermetically-sealed microminiature potentiometer, 12-turn, 50k. This is a high-quality trimmer availble only from industrial suppliers. The unit cost is $9.22, but a similar inexpensive pot can be substituted. Substitutes should also be hermetically sealed, however.

effect, changing the bias changes the tuning. That's one reason why an on-board regulator is necessary. Unfortunately, an emitter resistor can't correctly be used with the input amplifier as was done with the local oscillator, so a different negative-feedback network which requires an initial adjustment was necessary.

Optimum performance won't be achieved if the bias conditions differ very much from the required V_{ce}=15 V and I_c=25 mA. To compensate for differences in dc beta between similar devices, the input amplifier's base resistor, R_B, should be chosen to provide this bias point accurately. Note: For both the input amplifier and local oscillator, be very careful to apply V_{cc}=20 V only after the bias network is complete because the open-base breakdown voltage, V_{ceo}, is 20 V; the transistor may be destroyed otherwise. With the base connected, BV_{ces}=30 V, minimum, so there is no danger if the network is complete.

Accurately measure all the input amplifier's bias resistors before they are soldered in so that I_c can be calculated from their operating voltage drops. Adjust base potentiometer R_B to approximately 10k after connecting its wiper to either end, and then solder its two ends into the board. Note that the photographed board used a fixed resistor for R_B; finding an accurate fixed value is a tedious process. During tune-up, power is applied (via the BNC connector) and R_B is adjusted to provided V_{ce}=15.0 V. I_c is then calculated from the bias network voltages and resistances.

It probably won't be possible to simultaneously achieve the required current and voltage exactly without varying R_{B1} as well as R_B, so a tradeoff is necessary; e.g., 15.2 V and 25.2 mA would be a better choice than 15.0 V and 25.6 mA. The input and output of the input amplifier are shunted to ground through quarter-wave bias stubs with a chip and tantalum capacitor. This acts as a shunt bandpass filter, shorting all lower frequencies.

Output Amplifier

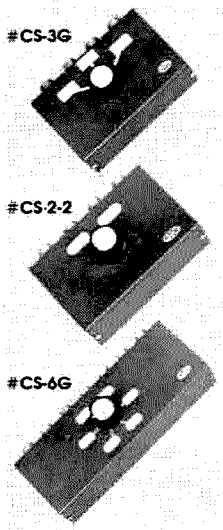
This is a basic two-stage amplifier with three resonators to provide the desired overall bandpass response. Although MOSFETs have advantages over bipolar transistors, one precaution which must be observed has to do with susceptibility to static discharge. It would be a good idea to connect the MOSFETs last, working above a grounded benchtop. Once soldered in, the danger is over.

Tune-Up

After the converter has been built but before connecting any of the four transistors, the first step is to measure the output of the on-board regulator with an input of about 25 V; if it doesn't supply an accurate 20 V, adjust one or both of its resistors Until it does:

$$V_{cc} = 1.25[1 + (R_2/R_1)].$$

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Next, after the board is completed (with R_B preset) and mounted in the case with the connectors soldered, tune-up consists of adjusting R_B as already explained, adjusting the local-oscillator frequency with its trimmer capacitor (with the power supply set at midrange), and then peaking the three slug-tuned output-amplifier inductors, which provides a 6-MHz overall bandpass response. In actual use, with the output resonator loaded by a 75-Ohm television input instead of a 50-Ohm spectrum analyzer, the response would be broader.

The local-oscillator signal can be monitored at the converter output with either a spectrum analyzer or microwave frequency counter if either is available. If not, the transmitted signal should be usable for tune-up since the resonators don't peak sharply. Butterworth bandpass response would require different component values, and alignment equipment would be mandatory. For an input at 2.153 GHz and the output tuned to channel 3, centered at 63 MHz, the oscillator is tuned to 2.216 GHz. The voltage tuning range is broad enough to tune both the correct and image oscillator frequencies.

My antenna consists of a feedhorn placed at the focus of a parabolic dish. In a strong signal location, a dish isn't necessary; the feedhorn itself can be used as the antenna since the dish only increases the area over which the signal is collected. The feedhorn produces a microwave standing wave within itself so that the signal can be picked off with a quarter-wave dipole. For a given frequency, the dipole's optimum position in the feedhorn depends on the "guide wavelength," which depends on the radius of the circular waveguide used. I prefer to use other than coffee cans because of their ribs. I chose a can which was used to ship silicon wafers because the sides and end are very straight and smooth, more like a commercial waveguide section. This means cleaner internal reflections with no scattering.

For a feedhorn with a 2.0-inch radius operating at 2.153 GHz, the dipole is placed 5.8 cm from the closed end of the can (parallel to it). The dipole should be oriented vertically since that is the normal transmission polarization. There may be an adjacent channel with horizontal polarization. The quarter-wave dipole is made by soldering a piece of semi-rigid coaxial tubing to an appropriate SMA connector, removing the shield all the way to the connector, and then trimming the center conductor to 3.3 cm long. I use thin silver/teflon RG-316/U cable with an SMA connector on each end to connect the antenna to the converter. The input impedance was designed to be 50 Ohms; it should be possible to use other antenna systems, cable configurations, or preamplification stages if desired.

Summary

When I completed the project, I was entirely satisfied with this converter and felt I could recommend it to others without reservation. Unfortunately, I have since experienced one problem with the most recent set of ten HXTR-2102 transistors I purchased: Some input amplifier transistors have failed, even though they were operated at the manufacturer's recommended bias point. There have been no local oscillator failures, but these are operated at a lower power level. This seems to be a manufacturer's isolated lot problem, but I can't be certain since I no longer have access to the array of sophisticated equipment used during development. This problem may be augmented by the tantalum capacitor on the base of the input amplifier transistor, since this holds the transistor off for approximately 10 milliseconds; with no current being drawn, 20 V appears at the collector for this time. Although it doesn't strictly apply, this happens to equal the absolute maximum rating for V_{ceo}. As a precaution, one may want to remove this tantalum capacitor and run the on-board regulator at 19.1 V instead of 20.0 V by changing R1 from a 200-Ohm to a 210-Ohm, 1%-tolerance resistor. If no other changes are made, the input amplifier will then be slightly detuned by operating somewhere near 15 V and 20 mA, depending on the adjustment of R_B. One can always totally eliminate the input amplifier transistor by removing all the bias and tuning stubs from the input line with a razor blade and using a copper-foil short in place of the transistor; this would mean the loss of about 14 dB of gain and some sensitivity.

For a better understanding of this project's design, or for practical application in another project, copies of my design notes are available. They include explanations, test data, and all calculations, including Smith Charts, waveguide and microstrip calculations, and a table of microstrip transmission line impedances. I will send copies of these notes first-class postage-paid for $4.00. Many parts are available only from industrial suppliers and so are difficult to obtain. I intend to supply a set of parts; write to me for details. ■

Jeff Schwartz KA2QOU
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Margate City NJ 08402

Get With the Program and Speed Up Your Code

Here's an opportunity to increase your code speed without QRM, QRN, or QSB!

As the son of two licensed amateur-radio operators, it was natural that I would find hamming an interesting hobby. The theory was no problem for me as I have always been interested in electronics, but the code did not come quite so easily. I practiced and practiced, and finally passed my Novice examination.

Soon after receiving my Novice license, I realized that upgrading was a must. The code requirement of thirteen words a minute seemed insurmountable. Because I am a high-school student, my time is somewhat limited and time devoted to code practice became less and less. Finally I decided to wait for the summer, when I could devote as much time as I wanted toward getting my General ticket.

The summer came, but I soon realized that I was not making any progress trying to increase my code speed by operating in the Novice bands, and as an Apple computer enthusiast, I decided to put my computer to work with a program to send random code.

After I completed this program, I modified it to show me what it sent and to check my copy for any errors. Back to the drawing board once again. The new program would send the code and then prompt for the letters, numbers, or symbols when it was finished sending whatever number of characters the user desired. I also added into the program a method of scoring the user for the number of correct and incorrect characters copied. The next problem that I faced was: If I missed a number of characters while I was practicing, I could not be sure which character was next in line when I was checking what I had copied. I overcame this by having the program show the user all of the characters on screen in the order sent.

When this program was completed I still wasn't satisfied. It was partly because I enjoyed working on it and I was sorry the effort was over; so I rewrote the program with several enhancements. First I made it menu driven. The user can select the mode of practice he wants to take, the speed, and the tone, all from a series of menus.

Other enhancements included a drill that shows on the screen the character sent less than a second after the code sound is sent. This gives the user enough time to recognize the character in his mind, but not enough time to think about it or break down the character in his mind.

The new version of the program was just about complete when I decided there was one more modification it needed. I made the program keep the speed that the character is sent at 15 wpm and varied only the time between characters. The menu allows you to select the code speed you wish to copy, but only the space between characters changes, not the speed of the code itself. This results in a program that makes it easier for you to increase your speed because you are already used to the pattern of faster code. This method also makes taking the code apart in your mind almost impossible; you learn to recognize the characters only by their sound.

This program is written completely in Applesoft Basic and will work on the Apple II+ or IIe. It uses two machine-language subroutines that are POKEd into memory when the program is run. These routines are at location $300 and perform two needed functions that can be used in your own programs.

The first of these routines generates the tones. If you run this program and then exit it, the routines will be in memory. You can BSAVE them for your own use. To use the tone routine, POKE the pitch into location $0 and the duration of the note into location $1; then CALL 768 will play the desired note.

The second of these routines is used to scramble the random-number generator. This is done by scanning the keyboard and choosing a random number. If a key is pressed, then it continues, and if not, it does it again and again. This means that while waiting for a keypress, the program is scrambling the random numbers that will be used. This is needed because when the disk is first BOOTed, the random-number generator is given a seed number. The routine just steps through these to make them "more random."

To begin, run the program. A menu will appear on the screen and ask for your choice. The choices displayed are, first, practice drill, which is a drill that is scored and will prompt for the number of characters

you desire to receive. The second option is the visual drill. This drill shows the character sent on the screen just after it was sent. The third option on the menu is to change the tone. Enter a number from one to 255. The fourth option is the speed control and gives a sub-menu with your choice of speeds. The last option on the menu is to exit the program to Basic. Any key pressed other than those indicated will be ignored. When you use the first drill, the speed remains unchanged. This is not the case with the second drill. The second drill, when exited, will reset the speed back to 15 wpm. When the program is run, all speeds are set to 15 wpm until changed.

This program, as well as your Apple itself, can be greatly enhanced by adding a simple and inexpensive modification. The Apple is a remarkable piece of hardware, but there is a flaw. The audio of the Apple is not up to par. Part of this is due to the small size of the speaker. With the following simple modification, you can give your Apple a very loud voice.

An audio output transformer is required, such as Radio Shack part number 273-1380. The primary of the transformer (blue and green leads) is connected via a length of shielded cable to the auxilary input of any amplifier. The secondary (red and white leads) is connected to the speaker of the Apple. The best way to do this is to splice into the wires of the speaker. The speaker of the Apple is located face down on the left side of the Apple near the keyboard.

When this modification is made, the center tap of the primary of the transformer (black lead) should be cut off; it is not needed. The audio of the Apple will work normally but also will be fed through your amplifier. I use the amplifier in my color monitor. This simple modification will make this code program more useful and will enhance any Apple application using sound.

This program has helped me and I hope that it will help you, too. The modification can be made with only a small investment in a transformer and some cable. This program will operate without it, but by enhancing the sound of the computer, the program sounds better. Due to the excessive length of this program, I will supply it on a DOS 3.3 disk upon receipt of a check for $10.00 and a self-addressed mailing label.

Here is your opportunity to increase your code speed with no QRM, QRN, or QSB, and at your own convenience. Enjoy!■

Program listing.

```
10  RESTORE
20 P = 100: POKE 0,P
30 SP = 30
40  DIM A$(39),C$(39),Q$(1000)
50  DATA     173,48,192,136,208,4,198,1,240,8,202,208,246,166,0,76,0,3,96
60  DATA       141,16,192,32 ,174,239,173,00,192,201,128,144,246,96
70  DATA  01,A,1000,B,1010,C,100,D,0,E,0010,F,110,G,0000,H,00,I,0111,J,10
    1,K,0100,L,11,M,10,N,111,O,0110,P,1101,Q,010,R,000,S,1,T,001,U,0001,
    V,011,W,1001,X,1011,Y,1100,Z
80  DATA  01111,1,00111,2,00011,3,00001,4,00000,5,10000,6,11000,7,11100,8
    ,11110,9,11111,0,010101,.,001100,?
90  DATA   110011,","
100  FOR I = 768 TO 800: READ X: POKE I,X: NEXT
110  FOR I = 1 TO 39: READ C$(I): READ A$(I): NEXT
120  TEXT : HOME : VTAB 11: PRINT  TAB( 8);"PRESS ANY KEY TO START"
130  CALL 787
140  GET A$
150  TEXT : HOME
160 C = 0:W = 0
165  HOME
170  INVERSE : FOR I = 1 TO 39: PRINT " ";: NEXT : PRINT : NORMAL : PRINT
     "  MORSE CODE PRACTICE PROGRAM      V1.1"; FOR I = 1 TO 39: PRINT "-"
     ;: NEXT : PRINT " ";: INVERSE : FOR I = 1 TO 39: PRINT " ";: NEXT
180  NORMAL
190  PRINT : PRINT : PRINT  TAB( 17);"OPTIONS": PRINT : PRINT
200  PRINT "<1>. PRACTICE DRILL"
210  PRINT
220  PRINT "<2>. VISUAL DRILL"
230  PRINT
240  PRINT "<3>. SET TONE"
250  PRINT
260  PRINT "<4>. SET SPEED"
270  PRINT
280  PRINT "<5>. EXIT TO BASIC"
290  VTAB 22: PRINT "ENTER THE NUMBER OF YOUR CHOICE";: GET A$:A =  VAL (
     A$): IF A < 1 OR A > 5 THEN 165
295  HOME
300  IF A = 5 THEN  HOME : END
310  IF A = 4 THEN 920
320  IF A < 3 THEN 360
330  HOME : PRINT : PRINT
340  PRINT "ENTER THE PITCH (100 IS NORMAL)";: INPUT P$:P =  VAL (P$): IF
     P < 0 OR P > 255 THEN 330
350  POKE 0,P: GOTO 150
360  IF A = 1 THEN 500
370  HOME : PRINT "PRESS >>>RESET<<< TO EXIT THIS MODE"
380  POKE 34,1
390  POKE 1010,102: POKE 1011,213: POKE 1012,112
400 R =  INT ( RND (1) * 39) + 1
410 L =  LEN (C$(R))
420  FOR I = 1 TO L
430 S$ =  MID$ (C$(R),I,1)
440  IF S$ = "0" THEN  GOSUB 870
450  IF S$ = "1" THEN  GOSUB 890
460  NEXT I
470  GOSUB 910
480  VTAB 11: HTAB 19: PRINT A$(R)
490  FOR Z = 1 TO 90: NEXT Z: GOTO 400
500  REM  DRILL
510  HOME : PRINT : INPUT "HOW MANY CHARACTERS";CH
520  HOME : PRINT "   GET READY TO COPY CODE"
530  FOR Z = 10 TO 0 STEP  - 1
540  VTAB 11: PRINT  TAB( 19);Z
550  FOR DD = 1 TO 500: NEXT DD
560  IF Z = 10 THEN  VTAB 11: PRINT  TAB( 19);"  "
570  NEXT Z
580  HOME
590  FOR ZZ = 1 TO CH
600 R =  INT ( RND (1) * 39) + 1
610 L =  LEN (C$(R))
620  FOR S = 1 TO L
630 S$ =  MID$ (C$(R),S,1)
640  IF S$ = "0" THEN  GOSUB 870
650  IF S$ = "1" THEN  GOSUB 890
660  NEXT S: GOSUB 910:Q$(ZZ) = A$(R)
670  NEXT ZZ
680  REM  SCORE
690  HOME
700  FOR Z = 1 TO CH
710  PRINT "ENTER CHARACTER # ";Z;
720  GET U$: IF U$ = Q$(Z) THEN  PRINT " CORRECT":C = C + 1
730  IF U$ <  > Q$(Z) THEN  PRINT " INCORRECT    ";Q$(Z):W = W + 1
740  NEXT Z
750  PRINT : PRINT : PRINT "HIT ANY KEY TO CONTINUE";: GET U$: HOME
760  PRINT  TAB( 17);"ANSWERS"
770  POKE 34,1
780  PRINT
790  FOR I = 1 TO CH STEP 3
800  PRINT Q$(I),Q$(I + 1),Q$(I + 2)
810 G = G + 1: IF G = 10 THEN  PRINT "HIT ANY KEY TO CONTINUE";: GET G$:G
     = 0
820  PRINT
830  NEXT I
840  PRINT : PRINT " CORRECT ";C;"       INCORRECT ";W
850  PRINT : VTAB 23: PRINT "HIT ANY KEY TO RETURN TO THE MAIN MENU";: GET
     U$: GOTO 150
860  END
870  POKE 1,30: CALL 768: FOR Z = 1 TO 10: NEXT
880  RETURN
890  POKE 1,90: CALL 768: FOR Z = 1 TO 10: NEXT
900  RETURN
910  FOR Z = 1 TO SP: NEXT : RETURN
920  REM  MENU
930  HOME : PRINT "ENTER SPEED"
940  PRINT "-----------"
950  PRINT : PRINT
960  PRINT "<1>. 3 W.P.M."
970  PRINT
980  PRINT "<2>. 4 W.P.M."
990  PRINT
1000  PRINT "<3>. 5 W.P.M."
1010  PRINT
1020  PRINT "<4>. 7 W.P.M."
1030  PRINT
1040  PRINT "<5>. 9 W.P.M."
1050  PRINT
1060  PRINT "<6>. 10 W.P.M."
1070  PRINT
1080  PRINT "<7>. 13 W.P.M."
1090  PRINT
1100  PRINT "<8>. 15 W.P.M."
1110  VTAB 22: PRINT "ENTER THE NUMBER OF YOUR CHOICE";: GET A$:A =  VAL
     (A$)
1120  IF A < 1 OR A > 8 THEN 920
1130  IF A = 1 THEN SP = 3500
1140  IF A = 2 THEN SP = 2500
1150  IF A = 3 THEN SP = 1970
1160  IF A = 4 THEN SP = 1000
1170  IF A = 5 THEN SP = 700
1180  IF A = 6 THEN SP = 500
1190  IF A = 7 THEN SP = 200
1200  IF A = 8 THEN SP = 100
1210  GOTO 150
```

Dennis P. Blum KA7AWD
Rt. 3, Box 7644
Show Low AZ 85901

The Potabilities Are Endless

Dunk your next project into icky goo and discover why potting a circuit is even more fun than building it.

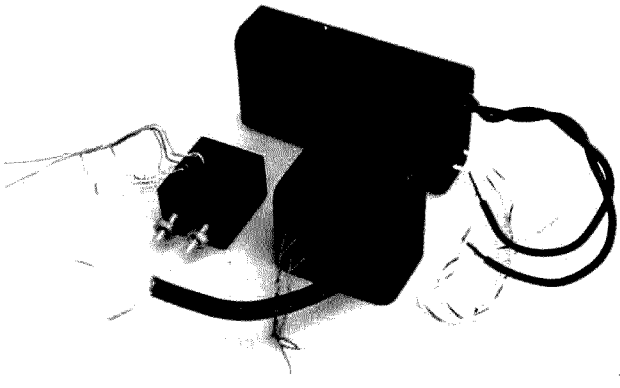


Photo A. Some examples of potting.

Have you ever had a circuit that you wished could be weather-proofed or ruggedized for severe vibration or other environmental effects?

Potting, or plastic encapsulation, could be the answer. Virtually any circuit can be encapsulated if it meets a few basic requirements. Number one, it should be completely tested to be sure it will operate satisfactorily—black cubes are hard to troubleshoot! Two, no adjustable components will be accessible once potted, so they cannot be included within the module. Connecting leads can be brought out, however, and variable components can be mounted externally. The third and last requirement is that the package should be relatively inexpensive. If something goes wrong, you're looking at a throwaway item unless you're into dissolving the potting compound.

The secret potting compound? It's available at any auto supply store; it's automotive body filler! Sold under many different brands, it's a polyester resin with styrene monomers added. A hardener is added to the mixture, and the substance

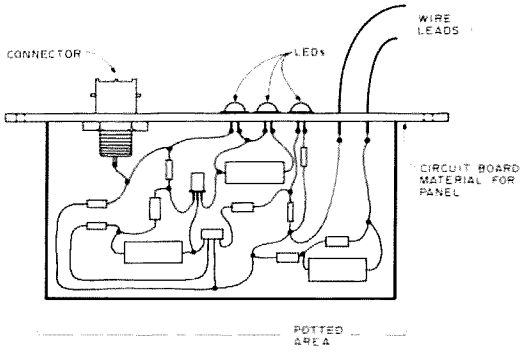


Fig. 1(a). A potted assembly which includes a panel for connectors and indicators.

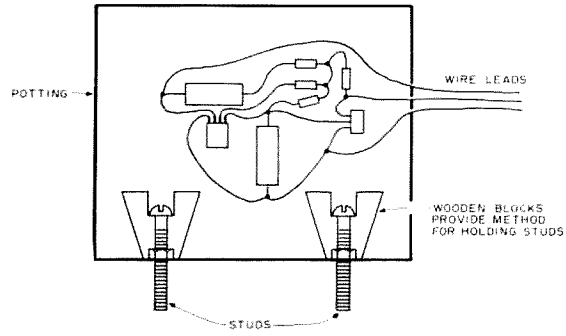


Fig. 1(b). A potted assembly with mounting studs which extend through the mold during curing.

cures in about 30 minutes. (Follow the directions on the container.) I have tested a number of different brands and all seem to have excellent mechanical properties and good dielectric strength. A 15-kV power supply potted over a year ago has functioned perfectly with no indication of insulation breakdown.

Making modules is easy; you can "hay-wire" the interior electronics together, saving on mechanical supports, sockets, and hardware. Make sure, however, that all solder connections are good and that nothing will short together during potting; don't forget to test!

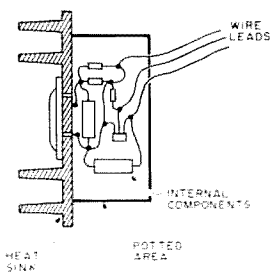


Fig. 1(c). An assembly with heat sink attached.

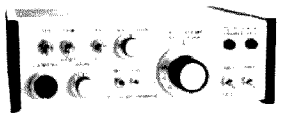
You will need some type of mold to hold the potting material while it is curing. I have used ice-cube trays, tin cans, small cardboard boxes, and plastic cases. Some can be break-away and others can be reused. Make sure the sides of the mold are coated with clear silicone grease to make extraction easier.

Figs. 1(a), 1(b), and 1(c) give some additional hints you can use for your modules. If you goof, remember that before the module has its final inspection, it can be filed, sanded, and painted. Any voids can be repaired with a second pour of additional material. A completed module can really look professional. Your friends will be asking where you bought that "special part" for your project. Happy potting! ■

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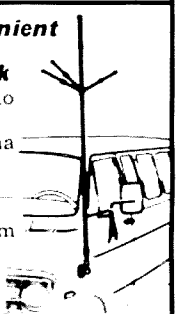
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The Basics of Computer CW

Here's a twist: W9ODK preprocesses Morse to make life easier for his VIC-20. The result? A Basic program that copies code from 5 to 50 words per minute.

Anyone who has tried to write a Basic program to receive Morse code knows that the primary problem is speed. A very simple program can be devised to copy at speeds up to about 30 wpm, but its capabilities are severely limited. Adding such niceties as automatic speed tracking and some rudimentary error checking results in a top speed of only 10 wpm. I find it hard to be impressed with a computer that copies code more slowly than I do.

There seem to be two ways around this problem. Write the program in machine language (not easy with the VIC-20 and an alien language to most casual programmers) or devise a smart interface to go with a dumb program. The latter choice is a departure from conventional thinking regarding computers, i.e., using the "intelligence" of the machine to its maximum capability. This article describes an interface which makes all of the decisions concerning speed, length of character elements, and spacing between characters and words. The computer is required only to decide which character has been sent and then display it on the screen. This combination is self-adjusting for speeds from 5 to 50 wpm (top speed still limited by the Basic interpreter), is very accurate even under difficult conditions, and is very easy to use. It appears to perform as well as any hardware/software combination now available.

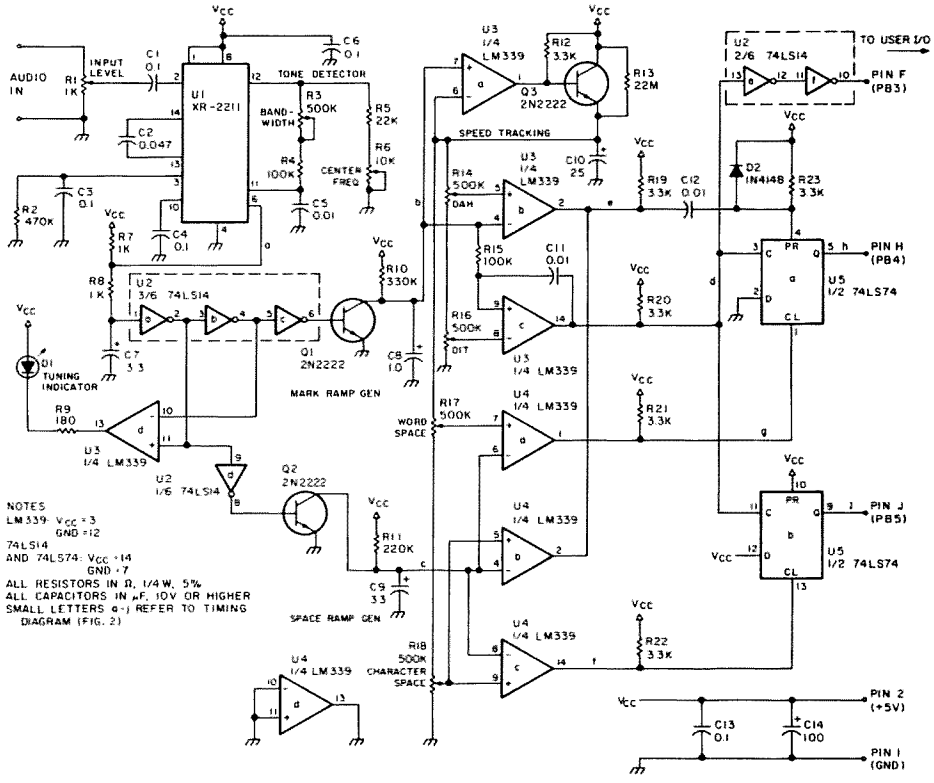


Fig. 1. Schematic diagram.

At first look, the schematic, Fig. 1, may appear complicated, but the circuit is really quite straightforward, using only five ICs, and it is easy to build and adjust. Total parts cost should be under $15.00.

Here is how it works: Audio from the receiver speaker is applied to the XR-2211 phase-locked-loop demodulator, here used as a tone decoder. Using the external components specified, it can be tuned from

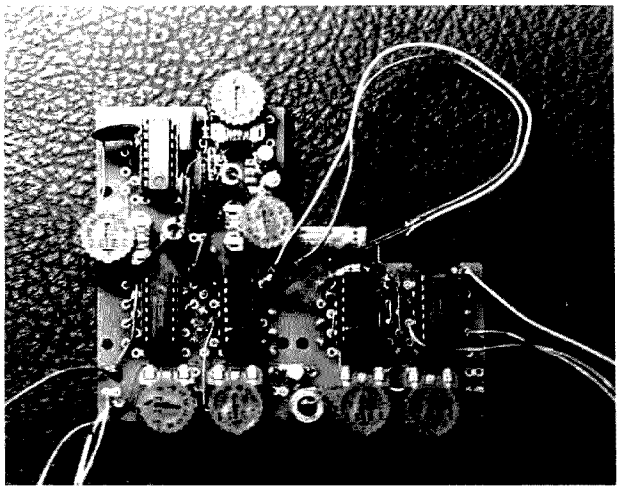


Photo A. The completed circuit board.

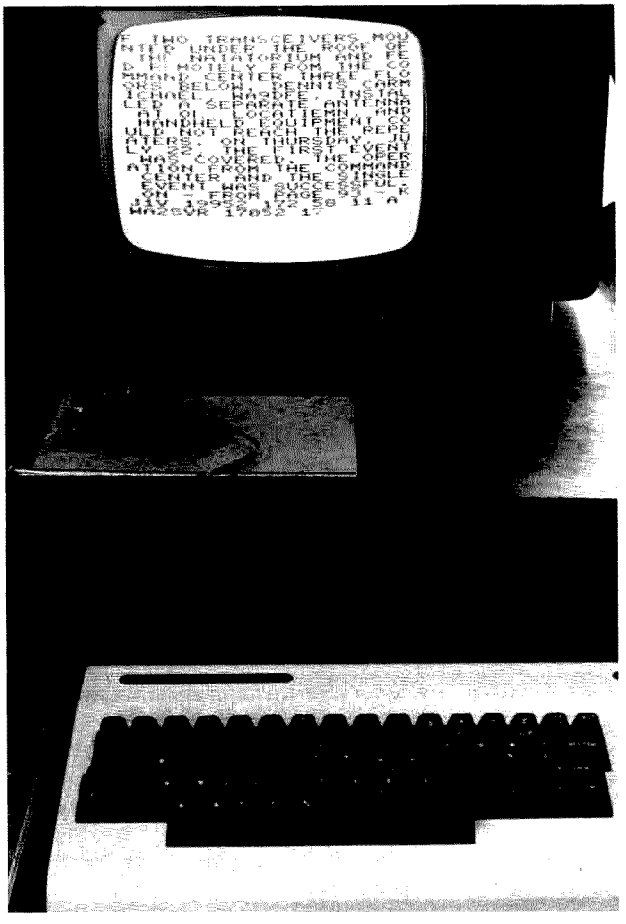


Photo B. Interface undergoing testing with W1AW code practice.

650 to 950 Hz and the bandwidth can be varied from 400 Hz down to about 70 Hz. The output from pin 6 is high when a tone is present. To prevent problems from noise spikes, the output of the 2211 is processed through an RC network (R8, C7) and several sections of a Schmitt-trigger inverter (U2).

Two separate voltage ramps are generated representing key down (mark) and key up (space). Refer to the timing diagram, Fig. 2. At slower speeds the ramps will rise to higher voltages, the rate of rise determined by RC networks R10-C8 and R11-C9. A peak-sensing circuit consisting of U3a, Q3, and C10 holds the highest level reached by the mark ramp generator. This becomes the reference by which character elements (dits and dahs) and spaces are determined. The speed reference voltage is established so quickly that only one letter need be sent before accurate copy begins. In fact, if the first letter starts with a dah, it will probably be displayed correctly.

A group of comparators, U3b–U4c, analyzes the two ramps to determine when a dit, a dah, a character space, or a word space has occurred. The outputs of the comparators control U5, a dual D-type flip-flop. There are four possible combinations of high and low levels from the Q outputs of the two flip-flops representing the above four events. Confusion could occur if there are two or more dits or dahs in a row, so a third signal line to the computer is needed. The output of the dit comparator, U3c, acts somewhat like a clock, telling the computer that a change has occurred.

Communication takes place through the user I/O port of the VIC-20. This port also supplies +5 V dc to operate the interface, so no other power supply is needed. Use of 74LS-series TTL and the low-power LM339 comparators keeps requirements within the 100-mA limit specified in the VIC-20 owner's manual.

What the computer does: The user I/O port, among other things, has a set of signal lines labelled PB0–PB7. See Fig. 3. These may be used as inputs or outputs; in fact, some may be inputs and others outputs at the same time. Referring to the program listing, the first line sets PB0–PB2 as outputs and PB3–PB7 as inputs. The interface is connected to PB3, PB4, and PB5. There are eight possible combinations of 1s and 0s on these three lines. Asking the computer to PEEK this port will result in a value between 192 and 248 in steps of 8. Four of

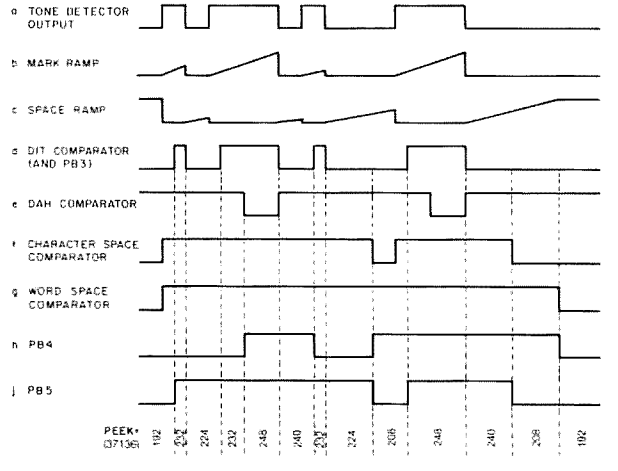


Fig. 2. Timing diagram.

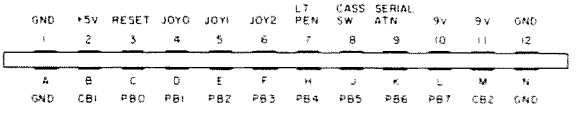


Fig. 3. VIC-20 user I/O port.

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these states are relevant and direct the program to calculate a value for the variable, D, which represents a particular character found in the string variable called LST$. When a character space occurs, it looks up the appropriate item in the list by means of the MID$ statement, prints that character, and resets D to 1. If a word space is received, it prints a space.

That's all there is to it. Because it's simple, it's fast. Incidentally, the ?s in the list just take up spaces and also make it likely that an error will appear as a ? in the text.

Getting it on the air: Building the circuit can be done however you wish using wire-wrap, point-to-point wiring, a universal prototyping board, etc. To connect it to the VIC-20, you will need a 12/24-pin card edge connector. A source for this connector is: Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002. The only other connection required is to the speaker output of the receiver or transceiver.

```
10 POKE 37138,7
15 LST$ = "?TEMNAIOGKDWRUS??QZYCXBJP?L,FVH09?8????7
   #???/-61????*?@2?.?3?45????"
20 A = 1: B = 2: C = 8: G = 67: H = 48: IN = 192: M = 256: S = 37136
25 D = A
30 IL = IN
35 IN = PEEK(S): IF IN = IL THEN 35
40 ON (M-IN)/C GO TO 30,50,30,60,30,70,30,80
50 D = D*B: GO TO 30
60 D = D*B: D = D + A: GO TO 30
70 IF D>G THEN D = D - H: IF D>G THEN 80
75 PRINT MID$(LST$,D,A);: GO TO 25
80 PRINT " ";: GO TO 25
```

Program listing.

Adjustment is not at all critical. Start out with all the pots at half rotation. Connect the sidetone from an electronic keyer, CW keyboard, or some other source of accurately-spaced Morse characters to audio in. You may want to start copying code right off the air, in which case W1AW code practice is an ideal source. Higher speeds are more critical, so the 35-wpm practice is best for setup.

Begin by adjusting the tone detector. With the receiver tuned to match the transmitter sidetone frequency or whatever pitch you normally use for CW, adjust R6 so that the LED tuning indicator (D1) flashes in sync with the code being received. With the receiver volume at normal listening level, turn R1 down until the LED goes out, then advance it just until the light responds to the CW signal and not background noise. It is important to keep the input to the 2211 as low as possible for best signal-to-noise ratio.

Once the tone detector is set up, characters should start appearing on the screen. Adjustment of the pots on the comparator inputs is best done while listening to a good clean signal of machine-generated code at 30 wpm or higher. Begin by turning the dit pot (R16) both clockwise and counterclockwise until dits begin to be missed, then set it midway between these two points. Follow the same procedure for R14, R17, R18, and their respective functions. Once these controls are set for 100% reliable copy on machine-sent code, do not readjust them. Probably you can find a setting that will copy the sloppiest fist on the air, but accuracy on good code will be compromised.

The only pot you might want as a front-panel control is R3, the bandwidth adjustment. It could be set at maximum bandwidth (minimum resistance) for easy tuning and changed to a narrower passband for heavy QRM. The phase-locked loop in the XR-2211 does a good job of rejecting signals out of its lock range. An interfering signal can simply be tuned off the edge of the passband by adjusting the receiver tuning dial or transceiver RIT. A bandpass filter was tried in the audio input line but didn't seem to be necessary.

Where to go from here: The POKE statement in the program leaves PB0–PB2 as outputs. There is a reason for this, namely to allow one of these lines to key the transmitter when a sending segment is added to the program, thereby making the VIC-20 a complete CW terminal. Two *73* articles should start you on your way to developing this program: "Apple, Morse, and You," AF2M, July, 1983; and "VisiCode: The VIC-20 Way to Extra Class," W7LTH and KA7AQA, August, 1983.

This interface and program will work equally well for the Commodore 64. For the C-64 change line 10 to 10 POKE 56579,7. In line 20, change S=37136 to S=56577.

If you would like a cassette copy of a complete CW send-and-receive program for the VIC-20 or C-64 which features message buffers and random code practice with variable speed and character spacing, send $6.00 to the author (this includes postage). Be sure to specify which computer you have.

Computers are rapidly becoming a part of the ham shack, and the easiest place for you to start is with a CW interface. Combining the oldest form of electronic communication with the latest in technology lends continuity to the ever-changing hobby of amateur radio. ■

Terminal Teletype

The last RTTY program you'll ever type for your H-89.

Program listing.

```
10 REM                          ******************
20 REM                          **  BASTTY.BAS  **
30 REM                          ******************
40 :
50 REM ************** Teletype Program, writ by R. E. Levin ***********
60 REM ***************     for H-89, with HDOS and MBASIC      ***********
70 REM ***************          May 1983.  Austin Texas        ***********
80 REM ***************                (W3RWU)                  ***********
90 :
100 CLEAR 2000
110 DIM L(32),F(32),L1(96)
120 E$=CHR$(27)
130 PRINT E$+"y1":M=38200'
140 PRINT E$+"E"
150 CF=2
160 OUT 220,0:REM *** TOGGLES DTR PORT FOR TRANSCEIVER PTT **********
170 PRINT:PRINT:PRINT"SELECT MODE-SPEED:"
180 PRINT "--------------------"
190 PRINT:PRINT"BAUDOT:"
200 PRINT"-------"
210 PRINT:PRINT"1. 60 WPM"
220 PRINT"2. 66 WPM"
230 PRINT"3. 75 WPM"
240 PRINT"4. 100 WPM"
250 PRINT:PRINT"ASCII:"
260 PRINT"------"
270 PRINT:PRINT"5. 110 BAUD"
280 PRINT"6. 300 BAUD"
290 PRINT:PRINT:PRINT:PRINT:INPUT " SELECT NUMBER ";S
300 IF S>=5 THEN FL=0 ELSE FL=1
310 ON S GOTO 320,330,340,350,360,370
320 A=199:B=9:C=4:GOTO 390
330 A=227:B=8:C=4:GOTO 390
340 A=210:B=7:C=4:GOTO 390
350 A=222:B=5:C=4:GOTO 390
360 A=23:B=4:C=7:GOTO 390
370 A=128:B=1:C=3
380 REM    ****** INITIALIZE SERIAL I/O ACE (8250) ********
390 OUT 242,2:OUT 219,128:OUT 216,A:OUT217,B:OUT219,C:OUT217,0
400 REM    ******* INITIALIZE PRINTER ACE (4800 BAUD) ***************
410 OUT 227,128:OUT 224,24:OUT 225,0:OUT 227,3:OUT 225,0
420 REM   ************* SET H-14 PRINTER TO 96 CHARAC./LINE **********
430 OUT 224,27:OUT 224,117:OUT 224,20
440 IF FL=0 THEN 510
450 RESTORE 3190
460 FOR I=0 TO 31:READ L(I): NEXT
470 FOR I=0 TO 31:READ F(I): NEXT
480 FOR I=0 TO 96:READ L1(I): NEXT
490 GOTO 510
500 PRINT E$+"E";:PRINT E$+"x5";
510 PRINT E$+"x5";
520 DEF FN Y$(X)=E$+"Y"+CHR$(31+X)+CHR$(62)
530 X=2
540 PRINT FN Y$(X);"SELECT FUNCTION:":X=X+1
550 PRINT FN Y$(X);"-------------------":X=X+1
560 X=X+2
570 PRINT FN Y$(X);" 1. RECEIVE (CTRL R during trans.)":X=X+1
580 PRINT FN Y$(X);" 2. SEND Kybd' (CTRL T during REC.)":X=X+1
590 PRINT FN Y$(X);" 3. RY Test (^U in ASCII)":X=X+1
600 PRINT FN Y$(X);" 4. CQ Msg.":X=X+1
610 PRINT FN Y$(X);" 5. CW IDentification (CTRL I)":X=X+1
620 PRINT FN Y$(X);" 6. Transmit a FILE.EXT from disk":X=X+1
630 PRINT FN Y$(X);" 7. Read buffer":X=X+1
640 PRINT FN Y$(X);" 8. Erase buffer":X=X+1
650 PRINT FN Y$(X);" 9. Write buffer to DISK":X=X+1
660 PRINT FN Y$(X);"10. Transmit canned message":X=X+1
670 PRINT FN Y$(X);"11. Return to main MENU (CTRL D)":X=X+2
680 PRINT FN Y$(X);"   (To put receiving msg. in buffer":X=X+1
690 PRINT FN Y$(X);"    use CTRL K)"
700 X=X+4
710 PRINT E$+"y5";
720 PRINT FN Y$(X);:INPUT"SELECT NO. ";H
730 ON H GOTO 740,1210,1840,2060,2260,1650,2690,2580,2430,2840,140
740 REM ********************** ASCII REC ROUTINE ****************
750 IF FL=1 THEN 920
760 OUT 220,0
770 PRINT:PRINT
780 K=INP(221)AND 1
790 IF INP(232)=20 THEN GOSUB 2590:GOTO 1210
800 IF INP(232)=4 THEN GOSUB 2590:GOTO 500
810 IF K=0 THEN 780
820 C=INP(216)AND 127
830 IF C=12 THEN 780
840 IF C=27 THEN 780
850 IF C>127 THEN 780
860 PRINT CHR$(C);
870 OUT 224,C
880 IF INP(232)<>11 THEN 780
890 POKE M,C:M=M+1:POKE M,255
900 IF M=56000' THEN M=38200'
910 GOTO 780
920 REM ************ BAUDOT REC ROUTINE ****************
930 OUT 220,0
940 PRINT:PRINT
950 K=INP(221) AND 1
960 IF INP(232)=4 THEN GOSUB 2590:GOTO 500
970 IF INP(232)=20 THEN GOSUB 2590:GOTO 1210
980 IF K=0 THEN 950
990 A=INP(216) AND 31
1000 IF A=27 THEN 1080
1010 C=L(A)
1020 PRINT CHR$(C);
1030 OUT 224,C
1040 IF INP(232)<>11 THEN 950
1050 POKE M,C:M=M+1:POKE M,255
1060 IF M=56000' THEN M=38200'
1070 GOTO 950
1080 K=INP(221)AND 1
1090 IF INP(232)=4 THEN GOSUB 2590:GOTO 500
1100 IF INP(232)=20 THEN GOSUB 2590:GOTO 1210
1110 IF K=0 THEN 1080
1120 A=INP(216)AND 31
1130 IF A=31 THEN 950
1140 C=F(A)
1150 PRINT CHR$(C);
1160 OUT 224,C
1170 IF INP(232)<>11 THEN 1080
1180 POKE M,C:M=M+1:POKE M,255
1190 IF M=56000' THEN M=38200'
1200 GOTO 1080
1210 PRINT:PRINT:REM ************** KEYBOARD TRANS ROUTINE *****************
1220 OUT 220,1
1230 GOSUB 3030
1240 P=ASC(INPUT$(1))
1250 IF P=9 THEN 2260
1260 IF P=27 THEN 1240
1270 IF P=4 THEN 500
1280 IF P=18 THEN 1290 ELSE 1300
1290 IF FL=0 THEN 740 ELSE 920
1300 PRINT CHR$(P);:OUT 224,P
1310 IF P=13 THEN OUT 224,10:PRINT
1320 IF FL=1 THEN L=P:GOSUB 1380 ELSE 1340
1330 GOTO 1240
1340 GOSUB 1580
1350 IF P=13 THEN P=10:GOSUB 1580
1360 GOTO 1240
1370 REM ************** BAUDOT SEND SUB-ROUTINE ****************
1380 IF L>=97 THEN L=L-32
1390 IF L=32 THEN 1530
1400 IF L=9 THEN 1540
1410 IF L=13 THEN 1570
1420 IF L>=65 THEN 1480
1430 IF CF=2 THEN 1470
1440 P=L1(L):GOSUB 1580
1450 CF=1
1460 RETURN
1470 P=27:GOSUB 1580:GOTO 1440
1480 IF CF=1 THEN 1520
1490 P=L1(L):GOSUB 1580
1500 CF=2
1510 RETURN
1520 P=31:GOSUB 1580:GOTO 1490
1530 IF CF=2 THEN 1550
1540 P=31:GOSUB 1580
1550 P=4 :GOSUB 1580
1560 GOTO 1500
1570 P=31:GOSUB 1580:P=8:GOSUB 1580:P=2:GOSUB 1580:GOTO 1500
1580 REM ****************** CHARACTER OUT SUB-ROUTINE ************
1590 X=INP(221)AND 32
1600 IF INP(232)=4 THEN CLOSE:GOTO 500
1610 IF X=0 THEN 1590
1620 P=P AND 127
1630 OUT 216,P
1640 RETURN
1650 REM ************ TRANSMIT A FILE FROM DISK ****************
1660 PRINT:PRINT:PRINT
1670 INPUT "                                FILE NAME ";N$
```

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APO NY 09283

After writing and using a Teletype® (TTY) program in assembly language, I was curious to see if MBasic, with its speed restrictions, would be able to do the same thing. This program is the satisfactory result of that quest. The program, operating at selected speeds from 60-wpm Baudot to 300-baud ASCII, will receive and transmit from the keyboard, write to or transmit from a disk file, send a canned message, provide a hard copy of received and sent traffic, and store received messages in a memory buffer.

Heath provided, with the 88-3 serial interface board, a simple way to interface a teletype terminal unit (TU) and other input/output (I/O) control functions. At the rear connector, P2, the TU is connected to pin 2 for data out and pin 3 for data in. Pin 20, the Modem Control Register, is used in this program to control the push-to-talk (PTT) of a transceiver. The first bit (bit 0) of port 220 (decimal), the Data Terminal Ready (DTR), is used for this purpose. The RS-232 levels of this port are used to control an optoisolator which in turn triggers a heavy-duty NPN transistor to key the transceivers, providing complete isolation of the H-89 computer from the "outside world." All RTTY control (except tuning) is done from the keyboard.

The Program

Line 390 initializes the Asynchronous Communications Element (ACE) for the desired baud rate and bit configuration as selected from lines 170–370 of the first menu. The H-14 printer is set up in lines 410–430. If hard copy is desired of either received or transmitted data, merely turn the printer on. Make sure the printer is on when you start

```
1680 OUT 220,1
1690 GOSUB 3030
1700 OPEN "I",#1,N$
1710 A$=INPUT$(1,#1)
1720 P=ASC(A$)
1730 P=P AND 127:L=P
1740 IF P<>13 THEN 1770
1750 IF FL=1 THEN P=8:GOSUB 1580:P=2:GOSUB 1580:PRINT:GOTO 1710
1760 GOSUB 1580:P=10:GOSUB 1580:PRINT:GOTO 1710
1770 PRINT A$;
1780 IF FL=1 THEN GOSUB 1380:GOTO 1800
1790 GOSUB 1580
1800 IF EOF(1) THEN 1820
1810 GOTO 1710
1820 PRINT:PRINT:PRINT:CLOSE
1830 GOTO 1210
1840 PRINT:PRINT:REM ************** RY (^U in ASCII) TEST  **********
1850 OUT 220,1
1860 GOSUB 3030
1870 IF FL=1 THEN 1920
1880 FOR I=1 TO 25
1890 P=42:PRINT CHR$(P);:GOSUB 1580
1900 P=85:PRINT CHR$(P);:GOSUB 1580
1910 NEXT I:GOTO 1960
1920 FOR I=1 TO 25
1930 L=82:PRINT CHR$(L);:GOSUB 1380
1940 L=89:PRINT CHR$(L);:GOSUB 1380
1950 NEXT I
1960 RESTORE 3330
1970 FOR I=1 TO 12
1980 READ P:L=P:PRINT CHR$(P);:IF FL=1 THEN GOSUB 1380 ELSE SOSUB 1580
1990 NEXT I
2000 PRINT
2010 IF FL=0 THEN P=10:GOSUB 1580
2020 IF INP(232)=20 THEN 1210
2030 IF INP(232)=4 THEN 500
2040 IF INP(232)=9 THEN 2260
2050 IF FL=1 THEN 1920 ELSE 1880
2060 PRINT:PRINT:REM ****************** CQ MESSAGE ******************
2070 OUT 220,1
2080 GOSUB 3030
2090 FOR I=1 TO 15
2100 P=67:PRINT CHR$(P);:GOSUB 2240
2110 P=81:PRINT CHR$(P);:SOSUB 2240
2120 P=32:PRINT CHR$(P);:GOSUB 2240
2130 NEXT I
2140 RESTORE 3330
2150 FOR I=1 TO 12
2160 READ P:PRINT CHR$(P);:GOSUB 2240
2170 NEXT I
2180 PRINT
2190 IF FL=1 THEN P=2 ELSE P=10:GOSUB 1580
2200 IF INP(232)=4 THEN 500
2210 IF INP(232)=9 THEN 2260
2220 IF INP(232)=20 THEN 1210
2230 GOTO 2090
2240 IF FL=1 THEN L=P:GOSUB 1380:RETURN
2250 GOSUB 1580:RETURN
2260 REM ********** CW ID SUBROUTINE ***********
2270 OUT 220,1
2280 GOSUB 3030
2290 RESTORE 3280
2300 B=INP(219)
2310 PRINT E$+"p"
2320 PRINT"   CW ID'ing   ";
2330 READ C
2340 OUT 219,C
2350 IF C<>1 THEN 2410
2360 PRINT E$+"q";
2370 PRINT E$+"1"
2380 OUT 219,B
2390 IF FL=0 THEN 740
2400 GOTO 920
2410 FOR I=1 TO 25:NEXT
2420 GOTO 2330
2430 REM ******************** WRITE BUFFER TO DISK ROUTINE ******************
2440 OUT 220,0
2450 IF M<=38200! THEN 3070
2460 PRINT:PRINT
2470 INPUT "Give the file a name and .EXT ";N$
2480 OPEN "O",#1,"SY0:"+N$
2490 M=38200!
2500 Q=PEEK(M)
2510 IF Q=255 THEN 2560
2520 IF Q=13 THEN 2540
2530 PRINT #1,CHR$(Q);:PRINT CHR$(Q);
2540 M=M+1
2550 GOTO 2500
2560 CLOSE:PRINT E$+"y1";M=38200!:GOTO 500
2570 REM ************** BUFFER STATUS MESSAGE ******************
2580 IF M<=38200! THEN 3070 ELSE PRINT E$+"y1";:M=38200!:J=4:GOTO 3080
2590 I=M-38200!
2600 IF I<=0 THEN RETURN
2610 PRINT E$+"j"
2620 PRINT E$+"x1"
2630 PRINT E$+"Y"+"8"+"42"
2640 PRINT E$+"p"
2650 PRINT"   There is a";I;"Byte message in the buffer.   "
2660 PRINT E$+"q"
2670 PRINT E$+"k"
2680 RETURN
2690 REM ******************    READ BUFFER   ROUTINE   ***********
2700 OUT 220,0
2710 IF M<=38200! THEN 3070
2720 PRINT:PRINT
2730 I=1
2740 PRINT CHR$(27)+"E";PRINT CHR$(27)+"H"
2750 I=38200!
2760 C=PEEK(I)
2770 IF C=255 THEN PRINT:GOTO 2820
2780 PRINT CHR$(C);
2790 I=I+1
2800 IF INP(232)=4 THEN 500
2810 GOTO 2760
2820 PRINT:PRINT"END OF BUFFER:";:INPUT"      Press RETURN for MENU";A$
2830 GOTO 500
2840 PRINT:PRINT:REM ************** CANNED MESSAGE ******************
2850 OUT 220,1
2860 GOSUB 3030
2870 X$="   TRANSMITTER HERE IS FT-101 (HF) AND TS-700A (VHF).@
ANT: CUSH-CRAFT, AT-4 VERTICAL (HF) AND 1/4 WAVE VERT. (VHF).@
TTY TU: HAL, ST-5, COMPUTER HEATH H-89, RUNNING HDOS & MBASIC.@
QTH: AUSTIN TEXAS."
2880 I=1
2890 L2=LEN(X$)+1
2900 A$=MID$(X$,I,1)
2910 IF I=L2 THEN 1820
2920 P=ASC(A$)
2930 IF P<>10 THEN 2970
2940 IF FL=1 THEN 2960
2950 P=13:GOSUB 1580:PRINT:P=10:GOSUB 1580:GOTO 3000
2960 P=8:GOSUB 1580:P=2:GOSUB 1580
2970 PRINT A$;
2980 IF FL=1 THEN L=P:GOSUB 1380:GOTO 3000
2990 GOSUB 1580
3000 I=I+1
3010 GOTO 2900
3020 REM ************ CR's & LF FOR START OF TRANS ROUTINES ************
3030 FOR I=1 TO 100:NEXT I:IF FL=1 THEN 3050
3040 P=13:GOSUB 1580:P=13:GOSUB 1580:P=10:GOSUB 1580:RETURN
3050 P=31:GOSUB 1580:P=8:GOSUB 1580:P=8:GOSUB 1580:P=2:GOSUB 1580:RETURN
3060 REM ************ EMPTY BUFFER MESSAGE  ********************
3070 J=0
3080 OUT 220,0
3090 PRINT E$+"x5"1
3100 PRINT E$;CHR$(89);CHR$(54);CHR$(60);
3110 PRINT "   NO MESSAGE IN BUFFER"
3120 FOR I=1 TO 200:NEXT
3130 PRINT E$;CHR$(89);CHR$(54);CHR$(60);E$+"K"
3140 FOR I=1 TO 50:NEXT
3150 J=J+1
3160 IF J=6 THEN 710
3170 GOTO 3100
3180 END
3190 DATA 0,69,10,65,32,83,73,85,13,68,82,74,78,70,67,75,84,90
3200 DATA 76,87,72,89,80,81,79,66,71,0,77,88,86,0
3210 DATA 0,51,10,45,32,7,36,55,13,36,52,39,44,33,58,40,53,42
3220 DATA 41,50,35,54,48,49,57,63,38,0,46,47,61,0
3230 DATA 31,31,31,31,31,31,31,5,31,4,2,31,31,8,31,31,31,31,31
3240 DATA 31,31,31,31,31,31,31,31,31,31,31,31,4,13,17,20,9,5
3250 DATA 26,5,15,18,20,17,12,3,28,29,22,23,19,1,10,16,21,7,6,24
3260 DATA 14,14,15,30,18,25,31,3,25,14,9,1,13,26,20,6,11,15,18,28
3270 DATA 12,24,22,23,10,5,16,7,30,19,29,21,17,15,29,18,3,3,5
3280 DATA 64,64,64,0,64,0,64,0,0,0,64,0,0,0,64,0,64,64,64,0,64,64,64
3290 DATA 0,0,0,64,0,64,0,64,0,64,64,64,0,64,64,64,0,0,0,64,0,64,64,64
3300 DATA 0,64,0,0,0,64,0,64,64,64,0,64,64,64,0,0,0,64,0,64,0,64,64,64
3310 DATA 0,0,0,64,64,64,0,64,0,64,0,64,64,64,0,64,0,0,0,64,0,64,0,64
3320 DATA 0,64,0,64,0,0,0,0,0,64,64,64,0,64,0,64,64,64,0,0,0,0,0,0,1
3330 DATA 32,68,69,32,87,31,82,87,85,47,53,13
3340 END
```

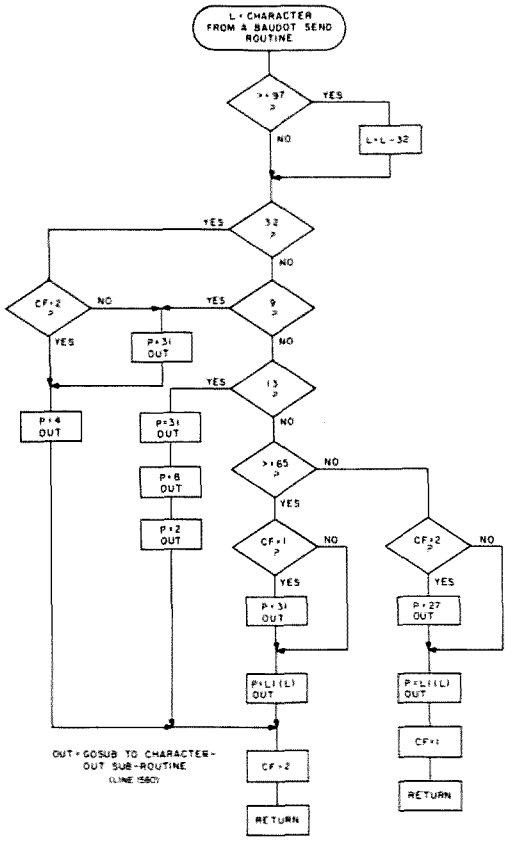


Fig. 1. Baudot send routine.

(RUN) the program. Line 300 sets a flag (FL) to 0 or 1 depending whether ASCII or Baudot is selected. Line 150 initializes a flag (CF) for Baudot upper- or lowercase. (2 = lowercase "letters.")

If Baudot is selected, lines 450–480 create arrays to convert ASCII characters to Baudot and vice versa. ASCII, of course, needs no conversion, so line 440 skips the arrays if ASCII is selected.

After selection of the mode/speed, lines 510–720 create the second menu, which will appear to the right of the first menu. Lines 510 and 710 turn the cursor off and on.

ASCII Receive

Lines 740–910 take ASCII characters from data-input port 216, print them on the screen, and send them to the printer port, 224. If during reception it is desired to store the message or any part thereof, striking a CTRL-K (ASCII 11) will place all incoming data in a memory buffer. Lines 880 and 890 accomplish this. Line 890 places the character in memory starting at address 38200 (decimal), increments once and inserts a decimal 255 (all bits "1"). Line 900 permits this buffer to extend to 56000, then resets to 38200, an 18K buffer. (If you have 48K RAM, the top should be set to 4000.) This buffer is not lost when returning to "SEND" or the menu, but to continue placing characters into the buffer after touching any key subsequent to the CTRL-K, it will be necessary to again hit the CTRL-K. This is because the last key struck remains in the keyboard port (232) until another key is struck. By the same token, striking any key after the CTRL-K (during receive) will halt placing characters into the buffer.

Line 780 checks the Line Status Register of the UART (ACE) to see if it is ready to accept another character. Bit 0 of this port (221) is set to logic 1 whenever a complete incoming character has been received and transferred to the receiver-buffer register of the ACE. If this bit is 0, line 810 loops the program back to line 780 and waits for the next character. In line 780, the byte from port 221 is logically ANDed with a one to toss out all but the first bit, bit 0. During this looping period, lines 790 and 800 check the keyboard to see if a CTRL-T or CTRL-D was struck to exit the routine.

The incoming-data byte is ANDed with 127 in line 820 to toss out the eighth, parity bit. This also has the effect of subtracting 128 from any received extraneous-noise characters between 128 and 255 decimal. Line 850 filters out these unwanted characters. Likewise, line 830 filters out a "form-feed" and line 840 gets rid of an "ESCAPE" character. Reception of an ESC followed by random characters can produce disastrous results. Line 860 prints the character to the screen and 870 sends it to the printer port.

Baudot Receive

The Baudot receive routine, lines 920–1200, has two loops—one for uppercase (FIGs) and one for "letters" (LTRs). The program jumps back and forth between them as it senses an incoming upshift, FIG character, line 1000, or a downshift LTR character, line 1130. The Baudot letters are converted to ASCII characters in line 1010, or Baudot FIGs converted to ASCII in line 1140. These conversion arrays were created from "DATA" in lines 3190–3220. Lines 990 and 1120 get the Baudot characters and AND them with 31 to toss out all but the five Baudot data bits.

Keyboard Transmit

Transmitting from the keyboard is accomplished in lines 1210–1360. Line 1220 turns the transmitter on, and the subroutine directed to in line 1230 is used at the start of all transmit routines. It provides a slight delay after turning on the transmitter and outputs two carriage returns and a line feed. The statement "INPUT$(1)" causes MBasic to read one character from the keyboard. P=ASC(X$) returns the ASCII code of X$ (line 1240). Line 1300 prints the character on the screen and sends it to the printer for hard copy (if the printer was turned on). Striking the RETURN key for a new line does not issue a line feed with this system. This is taken care of in lines 1310 and 1350. If the mode selected was ASCII, no conversion is required and the characters are sent to the output subroutine, lines 1580–1640. If Baudot was selected, then the characters are sent to the following subroutine.

Baudot Send Subroutine

Operation of this subroutine is best described with the aid of the flowchart, Fig. 1. The character flag, CF, has been set to 2 (LTRs) at the start of the program. ASCII characters from other routines enter as ASCII code integers, variable "L". The first line tests to see if they are lowercase ASCII (more than 97, beyond the range of conversion array L1, 0 to 97). If so, 32 is subtracted, making them uppercase ASCII. Next the character is tested to see if it is a "space." If so, a further test is performed to see if the previous character was a FIG or a LTR (Baudot). If both conditions are met, it sends out a Baudot space (4), sets the flag to 2, and returns. If the previous character was a FIG character, then a LTR (downshift) is sent before the Baudot space.

Next the program checks for a horizontal tab (ASCII 9). Tabs will not be processed, but a space will be

issued in Baudot. Line 1410 checks for a carriage return. If there is one, the program will send out a: LTRs, CR, and LF. If the character was not a CR, line 1420 makes the decision whether the character will be a Baudot upper (FIG) or a lower (LTR). All ASCII characters less than 65 will be Baudot FIGs. From here the previous character is checked for FIG or LTR by testing the CF flag. If the present character is different from the previous, with respect to FIG or LTR, the appropriate FIG or LTR shift is transmitted prior to the character. The ASCII character is converted to its Baudot code from the array in line 1440 or 1490. (DATA lines; 3220-3270.) If the present character is the same case as the previous, no shift command is given, the appropriate flag is set, and the program RETURNs to the proper routine.

Character-Out Subroutine

Timing speed (baud rate) is controlled by the UART (ACE). Lines 1590 and 1610 loop until the ACE is ready for another character. During this looping, line 1600 checks the keyboard for a CTRL-D to exit the routine and go to the menu. The CLOSE is there in case the EXIT was from reading an OPEN disk file. Line 1630 sends the character to the output port (216).

Transmit a File from Disk

Line 1710 reads one character from the disk file. Line 1720 returns the ASCII code of the character. HDOS/MBasic strips off all CRs when writing to a disk file. Line 1740 tests for this CR that the disk issues from sensing an LF. In this case, lines 1750 and 1760 will send out the required CR and LF.

The character is printed on the screen, and then the program loops back for the next character. Upon sensing the end-of-file (EOF), the file is closed and the program exits to the transmit keyboard.

RY Test and CQ Test

These are merely loops to read and send RYs (*U in ASCII) or CQ with a space. The end of these for-next loops drops to the call-sign loop, the DATA statement at line 330. These are ASCII codes for: "space DE W3RWU/5 space." Change this line of data for the call-sign of your choice. At the end of each line of test (or CQ), the keyboard is checked for a command to exit the loops and go to either keyboard send, CW ID, or the menu.

CW ID Routine

This routine uses the Line Control Register of the ACE to send a Morse CW ID. If bit 6 is set to a logic 1 (by sending a 64 to port 219), the serial-output ACE is forced to a space. When bit 6 of this port is set to a logic 0, it is forced to a mark. The data characters in lines 3280-3320 send my call. Three consecutive 64s are a dah, one 64 is a dit. Three consecutive 0s are a space between characters, and one 0 is the space between dits and dahs within characters.

This port (219) controls the bit configuration of the ACE, therefore it must be restored to its proper "BCON" at the end of this routine. Line 2300 sets the argument of variable B to this setting and 2380 puts B back into the port. Line 2410 is a delay to set the CW speed to about 15 wpm. Lines 2310 and 2320 put a reverse video message on screen, and lines 2360 and 2370 take the message off when the ID is finished and the program exits to the receive routine.

Write Buffer to Disk

This routine writes a simple sequential file to disk from what was stored in the buffer memory as loaded from the receive routine above. If the buffer is empty, line 2450 will vector the program to the "Buffer Empty" message and return to the menu.

Buffer Status Message

This routine is processed when anything is in the buffer as a result of a CTRL-K during receive. Variable I in line 2590 determines how many bytes are in the buffer, and lines 2610-2670 display this quantity on the 25th line.

This message will now stay on the 25th line until erased by selecting "8" of the menu or reading the buffer to disk (or re-RUN the program).

Read Buffer Routine

This routine will simply read back to the screen whatever is stored in the buffer.

Canned Message Routine

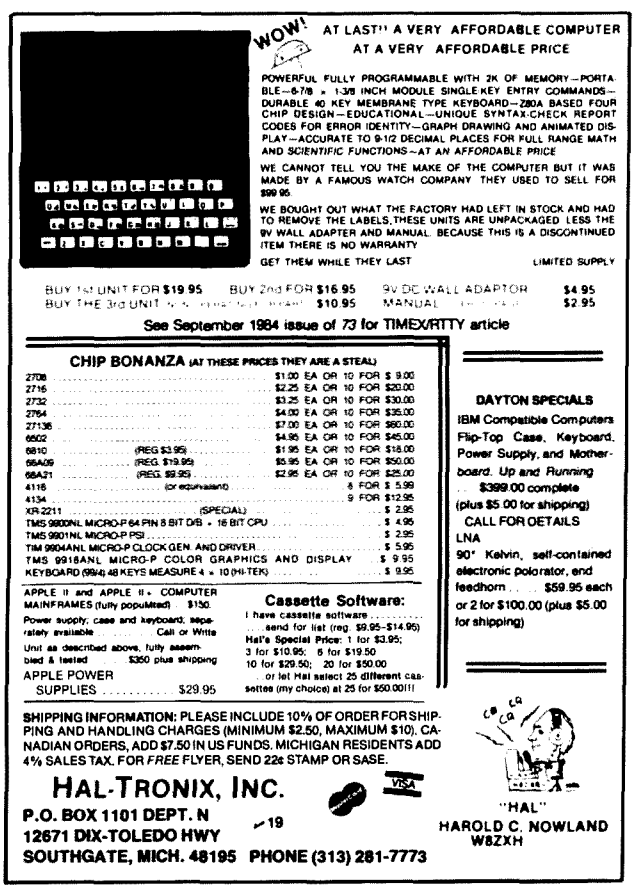
Here is a canned "brag" message that can be 256 bytes in length. The string X$ is the message and the @ will issue a CR and LF, although it is one continuous line in MBasic. Line 2980 reads the string one character at a time, and line 2910 tests for the end established in line 2890.

Empty Buffer Message

If the buffer is empty upon selection of 7, 8, or 9 of the menu, this subroutine will superimpose "No Message In Buffer" over the "SELECT NO." statement of the menu. This is accomplished using the direct cursor-addressing feature of HDOS.

This program should be easily adaptable to other machines using MBasic by appropriate changes to the commands and statements esoteric to the H-89, e.g., cursor addressing, screen blanking, port address, etc. Of course, the versatile features of the 8250 ACE are required for this program to work without timing delays.

Many thanks go to Dale Cockle K5JIC for his patient testing and helpful suggestions to get the program running.■



Dave Malley K1NYK
97 Bette Dr.
Manchester CT 06040

Malley's Manchester Monitor

Listen in on the world's finest conversationalist — you!

Over the past several years my Yaesu FT-101E has been modified rather extensively. This was due in part to an interest in improving the receiver section for contesting. The other factor was an uncontrollable need for its owner always to have a hot soldering iron in his hand. In any event, the radio gradually improved to the point where it seemed to play as it should from a competitive sense. However, a new feature became desirable during the past year—the ability to monitor the transmitter's audio in the headphones.

When the manufacturers initially introduced the monitor feature, it seemed more like another bell or whistle than the solution to a real need. Perhaps it still is, but I have found that there are several reasons that make this feature rather convenient.

The first hint of desirability came when I was operating a multi-operator/single-transmitter (multi-single) DX phone contest. We found that having boom-microphone headsets for both operators was invaluable when working split frequency on 40 meters. This is necessary since European amateurs cannot transmit above 7100 kHz. Here the monitor function allowed both of our operators to know when the other was transmitting. Another benefit was found when using a closed-loop CQ tape; there was less clutter involved in patching the tape-recorder audio into the operator's headphones.

You may be thinking that this might be great but if you're not a contester, who needs it? Well, I have found that there's something of a psychological boost to hearing your audio directly in the headphones during normal SSB operation. Also, commercial full-duplex FM headsets are used for communication in high-noise areas at work. These radios also have a monitor feature which the operators find really helpful.

Having determined the fundamental need for yet another convenience item, it became necessary to determine how to add it to the transceiver. The typical circuit in commercial amateur rigs involves diode detection in one of the i-f stages. This procedure was selected presumably to allow the operator to hear the actual transmitted audio quality. It is a relatively complicated method and one which some believe does not accurately represent what the receiving station actually listens to (because of propagation delays and the detection circuitry itself). These considerations led me to sampling at audio frequencies, which is basically quite simple. While this article presents installation details which specifically relate to the FT-101E, the modification should apply to many other transceivers with minor changes.

The audio unit in the FT-101E is designated PB1315. One output of this circuit board goes to the transmitter modulator/oscillator section (PB1184A). Oscilloscope measurements showed that this audio output level was insufficient to properly drive the headphones. Consequently, a simple IC amplifier stage was required.

One of the restraints that was placed on the design was that only a single supply voltage be necessary so that the +13.5 V dc in the FT-101E could be used. Another was that all parts be locally available. An LM386 met these simple requirements and is capable of supplying about 0.4 Watts of output power. This is a popular IC which has been used for the audio section of direct-conversion receivers. These receivers require a very high audio gain to offset their typical lack of an rf amplifier stage. This linear IC can be configured as either a 20× or 200× amplifier. For our purposes, the lesser gain is more than enough and requires slightly fewer parts.

The circuit for the monitor board is shown in Fig. 1. The audio input to the LM386 is supplied through a disc-ceramic capacitor and a potentiometer gain control. A voltage divider is provided at pin 6 to drop the transceiver supply voltage from 13.5 V to 8.5 V, which is approximately the midpoint of the 4-12-V-dc allowable range for the LM386. This voltage is bypassed with a 0.01-uF capacitor to keep transients out of the chip. Note: A 10-uF electrolytic capacitor can be connected between pins 1 and 8 *if a 200× gain were desired for another application.* In this case, the negative side of the capacitor is connected to pin 8.

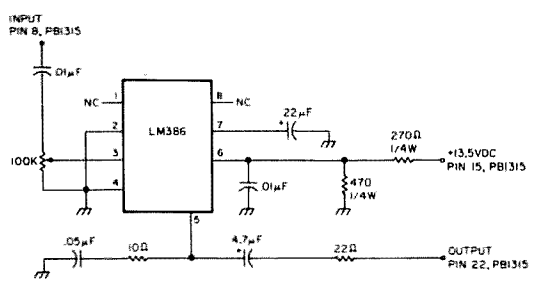


Fig. 1. The circuit for the monitor board.

The circuit can be assembled on a piece of perfboard or on an etched circuit board. Parts placement is not critical, although the bypass capacitor should be located as close as possible to pin 6. The PC board, foil side, is shown in Fig. 2.

Connect the monitor board input to pin 8 of PB1315 and the resistive divider to pin 15 or 16 of PB1315. The monitor output should be attached to PB1315, pin 22, which feeds the headphones. Miniature coax (RG-174) was used for these connections to eliminate any possibility of rf problems.

One of the more difficult problems encountered in modifying modern transceivers is finding a place to mount extra circuitry. I chose mounting the board on edge between the audio and modulator/oscillator units using one of the existing posts for support. This lets you adjust the amplifier gain if necessary and provides more space than that available under the rig's chassis. Once assembled, all that remains to be done is to talk into the microphone and adjust the pot until a comfortable audio level is heard in the headphones. It is advisable to turn the receiver's volume control off before setting this level since the receiver will be muted while you are transmitting. The monitor's gain pot is wired so that it can be turned off entirely if that should ever be desirable.

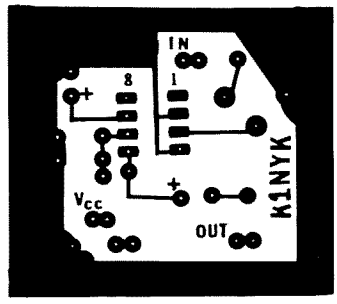


Fig. 2. PC board, foil side.

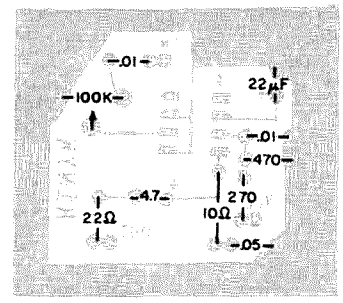


Fig. 3. Parts placement.

This is a simple modification that can be performed in a couple of hours at a leisurely pace. Thus, it is well suited for the newcomer to home-brew work. All parts can be obtained from your local Radio Shack store, as shown in the Parts List. Considerable variations in the electrolytic values can be made without significant effects. Likewise, the voltage divider can use other values as long as the voltage range noted above is not exceeded.

I have found that the monitor function has performed very well with good-quality microphone audio present in the headphones. Drop me a line if you have any questions on this modification (an SASE would be appreciated). ■

Parts List

2	.01 uF	RS272-131
1	.05 uF	272-134
1	4.7 uF	272-1024
1	22 uF	272-1026
1	10 Ohms	272-001
1	22 Ohms	271-005
1	270 Ohms	271-1314
1	470 Ohms	271-1317
1	100k Ohms	271-220
1	LM386	276-1731

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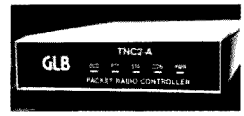
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Microprocessors incorporate a set of logical operators in their instruction code. Basic interpreters and compilers usually incorporate these features also. Even if your Basic does not include Boolean operators, you can still analyze digital logic circuits with it.

I became interested in the application of the Basic language to the analysis of digital circuits about the time I got my computer up and running. As a working engineer, I am acutely aware of the tedious nature of defining the expected operation of a digital circuit by hand. The possibility of reducing the effort needed to define the operation of a circuit was sufficient encouragement to pursue the possibility of doing it by computer. Although custom circuit-analysis programs have existed for about as long as the electronic computer, their cost and availability exclude the average user. The application of Basic to the problem promised a method of analysis and also provided an excellent opportunity to better understand the Basic language itself.

Let us then proceed in the following manner: First, we will investigate the existing logical operators. Then, we will define equivalents for the brethren who do not have the Boolean functions. Finally, we will develop some additional logic circuits with applications. The logic (or Boolean) operators normally encountered in microprocessor languages include the OR gate, the AND gate, and the XOR (exclusive OR) gate. Additionally, an equivalent of the exclusive NOR, the NOT, and additional functions may be had. The usefulness of functions other than the OR, AND, and the XOR is questionable, as they may not be defined for binary logic and may produce results which are not expected. For example, the NOT function on my machine is a two's complement of the sum of a number and one. The answer comes out as a negative number. The best solution is to use what you have but make sure that what you have works. Generate (or look up) a truth table for the operation you are verifying. If it works, use it. If it produces weird answers, don't use it.

If you have any Boolean functions in your Basic, they are probably:

- OR—Used to OR two words together. We will limit our words to the numbers 0 and 1. Although the possibility of using numbers from 0 to 255 (for 8-bit words) makes 16-bit-wide input gates possible, one must crawl before one can walk.
- AND—Same as OR except it performs the AND operation.
- XOR—If you have it, it exclusive ORs two numbers.

If we write a simple program to illustrate the use of these functions, it will look something like this (for standard or ANSI Basic):

```
10 FOR A=0 TO 1
20 FOR B=0 TO 1
30 PRINT A OR B;
40 NEXT B
50 PRINT
60 NEXT A
```

If we run this short program, we will get a display which looks like this:

```
0  1
1  1
```

The first line represents the ORing of A and B when A is 0 and B is first 0 then 1. The second line is for A = 1 and B is first 0 then 1. This is indeed the correct result of the operation of an OR gate. If AND is substituted for OR in the above program, the display will be:

```
0  0
0  1
```

This is the correct result for the ANDing of two digital signals. In like fashion, the XOR operator produces:

```
0  1
1  0
```

The first operator we will define is the inverter. This is an absolute necessity if we do any TTL analysis. Fortunately, the function is easy to obtain. For applications where we wish to recognize the invert operation, we can call this INV. We can define the operation as:

```
10 INV(0)=1
20 INV(1)=0
```

The application of this is shown as Inverter Operation in Listing 1, lines 10 and 20, where it is used to change an AND function to a NAND function. Instead of the name

```
5 REM ********************INVERTER OPERATION
10 INV (0) = 0 XOR 1
20 INV (1) = 1 XOR 1
25 PRINT:PRINT "NAND GATE":PRINT
30 FOR A=0 TO 1
40 FOR B=0 TO 1
50 PRINT INV(A AND B);
60 NEXT B
70 PRINT
80 NEXT A
90 END


Ok
RUN

NAND GATE

 1  1
 1  0
Ok
```

Listing 1.

```
5 REM ********************NAND GATE
10 LET N(1)=0
20 LET N(0)=1
30 FOR A=0 TO 1
40 FOR B=0 TO 1
50 S= N(A+B)
60 PRINT S;
70 NEXT B
75 PRINT
80 NEXT A
90 END


Ok
RUN
 1  1
 1  0
Ok
```

Listing 2.

```
5 REM ********************NOR GATE
10 LET N(1)=0
20 LET N(0)=1
30 FOR A=0 TO 1
40 FOR B=0 TO 1
50 S=N(A)*N(B)
60 PRINT S;
70 NEXT B
75 PRINT
80 NEXT A
90 END


Ok
RUN
 1  0
 0  0
Ok
```

Listing 3.

```
5 REM ********************OR GATE
10 FOR A=0 TO 1
20 FOR B=0 TO 1
30 INV(0)=1
40 INV(1)=0
50 PRINT INV(INV(A)+INV(B));
60 NEXT B:PRINT
70 NEXT A
80 END


Ok
RUN
 0  1
 1  1
Ok
```

Listing 4.

```
5 REM ********************XOR GATE
10 INV(0)=1
20 INV(1)=0
30 FOR A=0 TO 1
40 FOR B=0 TO 1
50 PRINT INV(INV(A*INV(B))+INV(INV(A)*B));
60 NEXT
70 PRINT
80 NEXT


Ok
RUN
 0  1
 1  0
Ok
```

Listing 5.

```
10 REM ********************ADDER
20 INV(1)=0
30 INV(0)=1
40 DEF FNS(C,X,Y)=(INV(C)ANDINV(Y)ANDX) OR (INV(C)ANDYANDINV(X)) OR (CANDINV(Y)A
NDINV(X)) OR (CANDYANDX)
50 DEF FNCA(C,X,Y)=(XANDC) OR (XANDY) OR (YANDC)
51 PRINT:PRINT:PRINT:PRINT
52 PRINT "S and C outputs for inputs X,Y and CARRY equal to"
53 PRINT
60 PRINT SPC(4);"X,Y= ";"0,0";SPC(5);"1,0";SPC(5);"0,1";SPC(5);"1,1"
70 PRINT "CARRY";:FOR Z=1 TO 32:PRINT "-";:NEXT:PRINT
80 FOR C=0 TO 1
90 PRINT C;SPC(2);":";SPC(2);
100 FOR Y=0 TO 1
110 FOR X=0 TO 1
120 PRINT FNS(X,Y,C);FNCA(X,Y,C);SPC(2);
130 NEXT
140 NEXT
150 PRINT
160 NEXT


Ok
RUN
S and C outputs for inputs X,Y and CARRY equal to
    X,Y= 0,0     1,0     0,1     1,1
CARRY----------------------------------
 0  :   0  0    1  0    1  0    0  1
 1  :   1  0    0  1    0  1    1  1
```

Listing 6.

```
5 REM ********************JK FLIP FLOP
10 LET B=1
20 LET CK=0
30 LET Q=0:E=0
40 INPUT "Enter 0 or 1 for J";J
50 INPUT "Enter 0 or 1 for K";K
60 INV(0)=1
70 INV(1)=0
80 FOR I=1 TO 20
90 IF J=CK=E=1 THEN Q=1
100 IF K=CK=INV(E)=1 THEN Q=0
110 PRINT Q;
120 IF CK=B=1 THEN E=INV(E)
130 CK=INV(CK)
140 NEXT
150 END


Ok
RUN
Enter 0 or 1 for J? 0
Enter 0 or 1 for K? 0
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
Ok


RUN
Enter 0 or 1 for J? 0
Enter 0 or 1 for K? 1
 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
Ok


RUN
Enter 0 or 1 for J? 1
Enter 0 or 1 for K? 0
 0  0  0  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
Ok


RUN
Enter 0 or 1 for J? 1
Enter 0 or 1 for K? 1
 0  0  0  1  1  0  0  1  1  0  0  1  1  0  0  1  1  0  0  1
```

Listing 7.

INV, we could use N (or for that matter any symbol which the computer will recognize). The use of the N with AND or OR functions better enables us to recognize the NAND or NOR operations. (See Listings 2 and 3).

For those who don't have logical operators, we can develop what we need from the arithmetic operators. The easiest to derive is the AND function. Since it is the same (for 0 and 1) for both logic and arithmetic, we can use the multiply (*) operator. A AND B can then be represented by A*B. For A and B having values of 0 or 1, the only case where A*B=1 is when both are 1, which defines the AND operation. The NAND gate can be derived by inverting the AND gate as shown in NAND GATE (Listing 2).

To derive the OR and NOR functions, we need to remember the Boolean identity which states, "inverting the output of an AND gate is the same as inverting the inputs of an OR gate." Conversely, "inverting the output of an OR gate is the same as inverting the inputs of an AND gate." (You might remember that the next time you need one type of gate and you have only the other.) The NOR gate is the easiest of the two to derive since it is the invert of A multiplied by the invert of B (see Listing 3). The OR gate is the invert of the NOR gate (see Listing 4). If you don't have the exclusive OR function, you should remember that: A XOR B = (INV(A) AND B) OR (B AND INV(A)). The XOR gate can also be derived without the aid of built-in logical operators, as seen in Listing 5.

If you have the define function (DEF FN), you can use it to generate additional logic operations such as the ADDER (see Listing 6). Additional logic functions such as flip-flops, counters, shift registers, etc., rely less heavily on strictly Boolean operations. For example, the J-K flip-flop can be represented without any Boolean operators (see Listing 7).

In analyzing circuits using counters, flip-flops, shift registers, and other devices using clocked signals, you should incorporate some method to ensure that your program simulates the clocked operation. Some cases exist where no special care need be taken (as in the following flip-flop example):

```
10 INV(0) = 1
20 INV(1) = 0
30 CK = 0
40 Q = 0
50 FOR I = 1 TO 10
60 IF CK = 1 THEN Q = INV(Q)
70 PRINT Q;
80 CK = INV(CK)
90 NEXT
```

It is usually necessary to provide some method of ensuring that the true clocked operation is simulated. This is accomplished in the above example by use of the INV(CK). Since CK is 1 every other alternation, Q will invert every other cycle, simulating a by-two frequency divider. In most cases, however, this is not sufficient, as often some form of gate is used to interrupt the clock signal. The result of this on the above routine will be a continual flipping of Q if CK is gated to a continuous high. This can be circumvented fairly easily by the in-

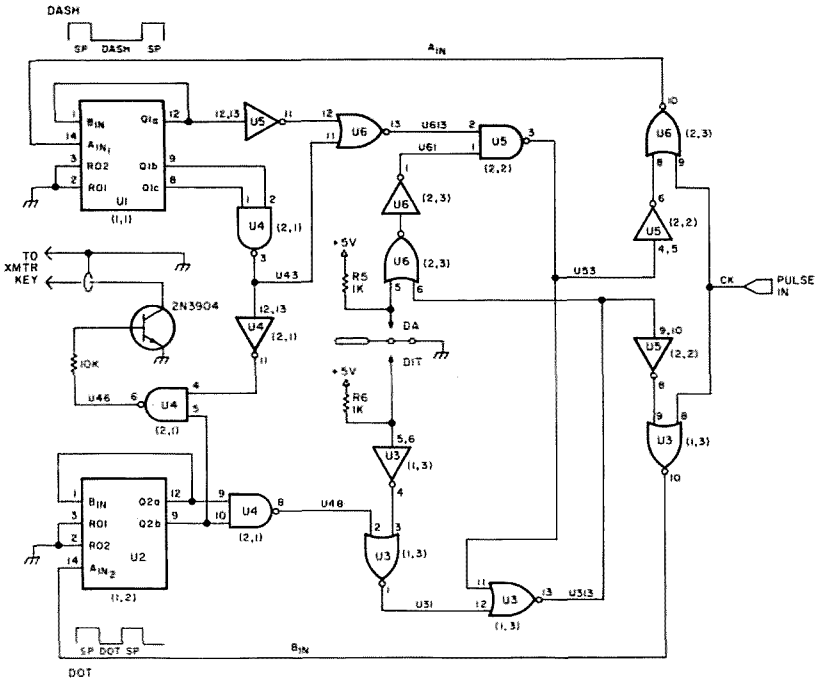


Fig. 1. Dot and dash generator.

```
10 REM ********************KEYER
20 D$="SPACE"
30 DA=1
40 DIT=1
50 CK=0
60 ACP=1:BCP=1
70 U53=0:U313=0
80 INV(1)=0
90 INV(0)=1
100 FOR I=1 TO 5:D(I)=INT(2*RND(1)):NEXT
110 D1A=D(1):D1B=D(2):D1C=D(3):D2A=D(4):D2B=D(5)
120 INPUT "ENTER 'DASH', 'DOT' OR 'SPACE':(enter 'QUIT' to end)";D$
125 LPRINT D$
130 IF D$<>"SPACE" AND D$<>"DASH" AND D$<>"DOT" THEN U3TO 420
140 FOR I=1 TO 20
150 CK=INV(CK)
160 IF D$="DASH" THEN DA=0 ELSE DA=1
170 IF D$="DOT" THEN DIT=0 ELSE DIT=1
180 IF CK=0 THEN D$="SPACE"
190 U43=INV(D1B AND D1C)
200 U613=INV(U43 OR INV(D1A))
210 U61=DA OR U313
220 U53=INV(U617 AND U61)
250 U48=INV(D2A AND D2B)
240 U31=INV(U48 OR INV(DIT))
250 U313=INV(U31 OR U53)
260 AIN=INV(INV(U53) OR CK)
270 IF AIN + ACP=0 THEN D1A=INV(D1A)
280 IF AIN + ACP + D1A=0 THEN D1B=INV(D1B)
290 IF AIN + ACP + D1A + D1B=0 THEN D1C=INV(D1C)
300 ACP=1
310 IF AIN=1 THEN ACP=0
320 BIN=INV(INV(U313) OR CK)
330 IF BIN + BCP=0 THEN D2A=INV(D2A)
340 IF BIN + BCP + D2A=0 THEN D2B=INV(D2B)
350 BCP=1
360 IF BIN=1 THEN BCP=0
370 U46=INV(U47) AND D2B
380 LPRINT U461
390 NEXT I
400 LPRINT:LPRINT
410 GOTO 120
420 END

SPACE
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

DASH
 1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  1

DOT
 1  1  0  0  0  0  1  1  1  1  1  1  1  1  1  1  1  1  1  1

SPACE
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

SPACE
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

SPACE
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

DOT
 1  1  0  0  0  0  1  1  1  1  0  0  0  0  1  1  1  1  0  0

DOT
 0  0  1  1  1  1  0  0  0  0  1  1  1  1  0  0  0  0  1  1

SPACE
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

SPACE
 1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1

DASH
 1  1  1  0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  0

DASH
 0  0  0  0  0  0  0  0  0  0  0  1  1  1  1  0  0  0  0  0
```

Listing 9.

```
5 REM ********************D FLIP FLOP
10 QA=0:D=0:A=1
20 INV(0)=1
30 INV(1)=0
40 PRINT "CK";"  D";" QA";" QB"
50 FOR I=1 TO 10
60 CK=INV(CK)
70 B=A OR CK
80 IF B=0 THEN QA=D
90 IF CK=1 THEN A=0 ELSE A=1
100 QB=INV(QA)
110 IF I=5 THEN D=1
120 PRINT CK;D;QA;QB
130 NEXT
140 END

Ok
RUN
CK  D  QA  QB
 1  0  0  1
 0  0  0  1
 1  0  0  1
 0  0  0  1
 1  1  0  1
 0  1  1  0
 1  1  1  0
 0  1  1  0
 1  1  1  0
 0  1  1  0
```

Listing 8.

corporation of a gating function, as shown in Listings 7 and 8 (the E in the J-K flip-flop and the A in the D flip-flop). These slightly different approaches produce the same result; that is to prevent the output from flipping without the proper clock signal.

Proper gated operation can be accomplished by gating this signal as an enable or by gating CK. CK can be gated by adding a gate in the D flip-flop or by using B in the J-K flip-flop. Either an AND gate can be used (as in the J-K flip-flop) or an OR gate can be added.

The schematic (Fig. 1) is of an electronic keyer which I built some time ago. It uses a 555 oscillator as an input and generates an output with a dot-to-space-to-dash ratio of 1 to 1 to 3, with self-completing dots and dashes. Speed control is obtained by controlling the frequency of the 555 oscillator. The key is a typical single-pole, double-throw switch normally used on electronic keyers. (I made mine from a telephone polar relay which I obtained from a surplus store.)

To verify that the circuit performed as expected, I wrote the keyer program to simulate the operation of the keyer (Listing 9). The program-run shown under the listing is the simulation of the circuit operation for an output of "spaces," "dot," and "dash"—i.e., one dot or one dash. This verifies the self-completing nature of the dots and dashes and also the dot-to-dash ratio. It can be seen that four clock pulses are necessary to complete one dot. The dashes are three times the length of the dots or twelve clock pulses long. The oscillator must then run at four times the dot rate (twelve times the dash rate) to obtain the desired speed.

To simulate keydown operation, line 160 must be removed. This prevents the program from assuming a "space" when the clock goes low. In fact, it forces the program to assume that the input condition (dot, dash, or space) remains until directed otherwise. The program (i.e., circuit) continues to generate the proper dot-to-space and dash-to-space ratios when running either dots or dashes.

The initial (i.e., power-up) conditions are established in lines 10 to 100. Either random (lines 90 and 100) or predetermined (line 60) may be used to define the initial conditions. The ACP and BCP signals are introduced into the program to simulate the edge-clocked operation of the counters. Without this

function, the counter is not restricted to counting only when the clock is toggled; it will count as long as CK is 0 if this function is not present. This is accomplished by lines 270, 280, 290, and 330, 340. ACP and BCP are set to 1 each time through and can only be set to 0 when AIN and/or BIN are/is set to 1. This results in counting occurring only when the clock is toggling. This or a similar procedure is necessary whenever a clocked-type operation is simulated. Lines 110 through 370 simulate the actual operation of the circuit.

The system which I used to assign variable names was to use the device name followed by the pin number—for example, U310 corresponds to device number U3, pin 10. This procedure may not work with your computer, however. It may be necessary to choose simpler names to ensure proper circuit operation. Otherwise, the computer can confuse the signals; e.g., if the computer is capable of recognizing variable names only two or three symbols long, it will confuse signals U310 and U31. This is determined by the Basic which you are using, so know what your Basic is capable of before you start assigning signal names.

If you decide that you need an economical keyer and wish to build one, a parts list and description of the operation of the keyer is included. It is very simple in operation, requiring only a single control for speed (plus a switch if you want multiple ranges) and working on the assumption that a space is one unit long, a dot is one unit long, and a dash is three units long. The circuit can be constructed from common parts found in your junk box or purchased at your local Radio Shack store.

The dash generator is composed of U1, NAND gates U4 (pins 1, 2, and 3) and U5 (pins 1, 2, and 3), OR

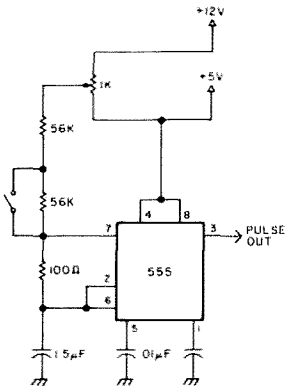


Fig. 2. Pulse generator.

gates U6 (two), and inverters U4 (output pin 11), U5 (output pin 11), and U6 (output pin 1). The dash circuit will toggle on power-up until QA, QB, and QC are all high. This will cause pins 11 and 12 of U6 to go low, driving pin 2 of U5 high. If the "paddle" is in the space or dot position, pin 1 will also be high. This will drive pin 3 of U5 low, which is inverted by inverter U5, driving pin 8 of U6 high, blocking further clock pulses to AIN. If pin 6 of U6 is low (more on that later), then moving the paddle to the dash position will cause pin 5 of U6 to also go low. This drives the output of the NOR gate high, which is inverted and drives pin 1 of U5 low. This results in pin 8 of U6 being driven low, which allows the clock signal (pulse in) to toggle U1 until the paddle is released and QA, QB, and QC are again all high. Additionally, until pin 3 of U5 goes low, signaling the end of the dash string, pin 11 of U3 will be held high, preventing the lower half of the circuit (dot generator) from functioning. The combination of the paddle being released and the necessity of QA, QB, and QC being high makes the dash self-completing.

In the truth table which follows, it can be seen that spaces occur during toggling when the count is 6 and 7, i.e., when pin 4 of U4 is high (pin 5 of U4 is held high as long as the dot generator is inactive). Since the

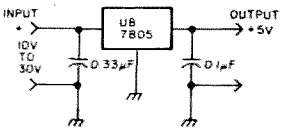


Fig. 3. Power supply.

total count is eight, and two counts are used for a space, the six remaining counts are reserved for the dash with a ratio of two to six (one to three).

7493 Truth Table

count	C	B	A
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

The dot generator is a simplification of the dash generator, requiring only the outputs QA and QB to generate the dots. As long as the paddle is held in the dot position, U3 pin 3 will be forced high, resulting in a low on pin 12 of U3. If the dash generator has completed its cycle, pin 11 of U3 will also be low. The resultant high on pin 13 of U3 will result in pin 6 of U6 being held high, blocking the dash generator, and pin 9 of U3 being driven low, allowing the clock pulse to toggle U2. Since the output is taken from QB, the dot-to-space ratio will be two to two (one to one). The dots will continue until the paddle is released and QA and QB are both high (i.e., the last dot is completed).

The pulse generator (Fig. 2) is a standard 555 circuit with minor exceptions. When varying the frequency in the normal manner, the resistance in series with the capacitor (the time-constant RC) is varied, which causes a nonlinear change in the charging current of the capacitor, forcing most of the frequency change to take place on one end of the control. By use of the potentiometer placed between the 12-V supply and the 5-V supply, the current supplied to the RC network will be linear. The frequency change will no longer have all of its change on only one end of the control. A decoupling capacitor (about 10 uF) can be connected to the center arm of the potentiometer to ensure maximum linearity, if so desired. Switch S1 can be used if desired to obtain a wider speed range. With the switch incorporated, the speed is about 5 wpm to 20 wpm in slow (S1 open), and about 10 wpm to 40 wpm in high (S1 closed).

The keying circuit is the output NAND gate, U4, the 10k resistor, and the 2N3904 transistor. This circuit was chosen to drive my Heathkit® HW-104 transceiver. If your transmitter requires a different keying method, you may redesign the output or insert a relay.

The 5-V supply (Fig. 3) is a 7805 regulator from the 12-V supply (most modern equipment is solid state and designed to run from 12 V). The .33-uF capacitor and the .1-uF capacitor are those recommended by the manufacturer when using the regulator.

As with all digital circuitry, a liberal sprinkling of decoupling capacitors should be used on the 5-V supply (one .1-uF capacitor at each device should be sufficient). Construction can be printed circuit if you care to lay out a board, or wire-wrap as mine is. I used 100-mil-spacing perfboard and wire-wrap sockets (both from Radio Shack) and wire-wrapped the circuit (using the little hand tool that Radio Shack sold me) when I was watching TV one night. The discrete components I mounted on a DIP header; I wire-wrapped a socket for them also. The cabinet is one of the small metal cabinets from the same source. You can either purchase a paddle or make your own as I did. If you have a surplus store in your area, look for a telephone polar relay. After the coil is removed, the remaining mechanical makes

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	U4, U5	7400
	U7	555
	U8	7805
Resistors	100 Ohms	¼ W
	56k Ohms	¼ W (2 ea.)
	10k Ohms	¼ W
	1k Ohms	¼ W (2 ea.)
Capacitors	.01 uF	
	.33 uF	
	1.5 uF	15 V
	.1 uF	(7 ea., for decoupling)
Miscellaneous	IC sockets	(8 ea.)
	Potentiometer	1k
	SPST switch (optional)	
	Cabinet	(Radio Shack #270-251)
	100-mil-spacing perfboard	
	Wire and solder as needed	

an excellent paddle.

Incidentally, the above computer simulation discovered a quirk in the circuit that I didn't know existed until I ran the program. If the simulation is run in the continuous-dash mode without first running a space, the program will not toggle. If the keyer is powered up with the paddle held in the dash position (same condition as the simulation), the keyer will duplicate the condition first observed in the program.

Well, whether you build the keyer or something else, use the computer to simulate a circuit—or just read and forget. Have a happy QSO and 73. ■

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Rock Solid Rf

Get pinpoint precision with this PLL-based frequency synthesizer.

Emil Ociepka
83-110 Tczew
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Poland

The main problem radio amateurs face in constructing a receiver or transceiver is ensuring constant frequency of the receiver heterodyne or the transmitter frequency. It is not so difficult to ensure stable operation of a vfo operating on a relatively low frequency and within a fixed range. The problem lies in ensuring constant frequency of an oscillator which has to operate within various bands (10, according to the latest band plan) and on a relatively high frequency.

The problem may be solved by using switched crystal oscillators in the band generator or by using the PLL (phase-locked loop) method when constructing the band oscillator. The use of this method under nonprofessional conditions is difficult since the system is quite complex and involves the use of proper programmed dividers and a filter in the vco control system which is difficult to optimize and which has to operate over a large frequency range.

My solution is to use the FLL (frequency-locked loop) method for frequency stabilization of the band oscillator. The advantages of this method are a relatively simple system and the possibility of applying it to already-constructed equipment. The use of the FLL

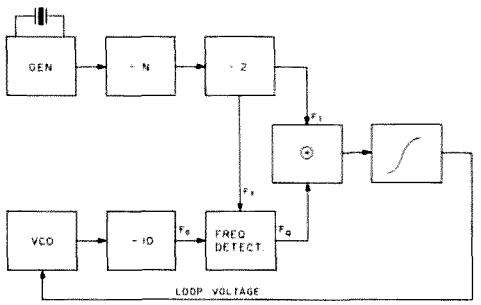


Fig. 1. Principle of operation of FLL synthesizer.

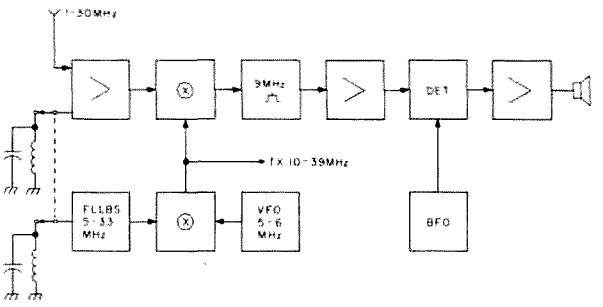


Fig. 2. Block diagram of radio receiver.

Received frequency F_R (MHz)	FLLBS frequency F_{H1} (MHz)	Vfo frequency F_{H2} (MHz)	Output frequency of heterodyne mixer (MHz)
1- 2	5.0		10-11
3- 4	7.0		12-13
7- 8	11.0		16-17
10-11	14.0		19-20
14-15	18.0	5-6	23-24
18-19	22.0		27-28
21-22	25.0		30-31
24-25	28.0		33-34
28-29	32.0		37-38
29-30	33.0		38-39

Table 1.

method for frequency stabilization of LC generators in the already-constructed equipment involves minimum system alterations while it considerably improves frequency stability.

Fig. 1 explains the principle of operation of the FLL system. The essential part is a flip-flop, type D, which functions as a harmonic mixer. Signals F_o from the vco and the clock signal, F_t, obtained from the quartz generator are supplied to its inputs D and C. The output signal of the flip-flop element, F_q, is expressed by the formula: $F_q = F_o - kF_t$, where k is a positive integer.

Obtaining the values of F_t and F_q as constants, we can change the frequency F_o in a function of the harmonic number k. In order to ensure constant frequency F_q, this frequency was compared with frequency F_t from the quartz generator. Both signals, F_t and F_q, are transformed into impulses with opposite polarization; added, their mean value is formed in the integrator, and they are amplified. From the amplifier output, the voltage of error is taken to adjust the frequency of the vco. Frequency F_q was, in my case, set at 50 Hz. Since frequencies F_t and F_q differ substantially, voltage levels F_t and F_q when added were also differentiated.

The Radio Receiver

The synthesizer constructed by me with the help of the FLL method is thought to be part of a radio receiver (and a transceiver in the future). A block diagram is shown in Fig. 2. As can be seen, the receiver system is of a conventional type. Single-frequency conversion was used with an i-f of 9 MHz. The vfo operates in the frequency range of 5 to 6 MHz. The receiver has ten bands. The determination of basic frequencies according to the formula $F_R = (F_{H1} + F_{H2}) - F_{i\text{-}f}$ and the determinations of the FLLBS synthesizer frequencies are given in Table 1.

The vfo is of a conventional construction: It is an LC generator. I intend to build a vfo also based on the FLL method, however. When constructing the whole receiver or transceiver, it is also possible to use the microprocessor vfos described in *73* (June, 1982); that output frequency is also 5-6 MHz.

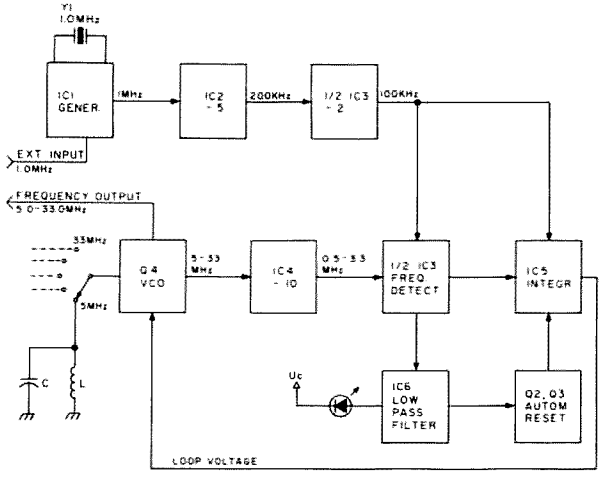


Fig. 3. Block diagram of band synthesizer.

The FLLBS Synthesizer

A block diagram of the synthesizer is presented in Fig. 3, while its schematic diagram is shown in Fig. 4 (digital part) and Fig. 5 (the vco). As can be seen from the drawings, the synthesizer is of a simple construction: All that is needed are several standard elements, and the cost of this system should not exceed ten to fifteen dollars.

The operation of individual parts of the system is as follows:

- The 1.0-MHz crystal oscillator is a typical one; it can operate on its own crystal or from an external 1.0-MHz generator.
- The next element (IC2) operates as a divider by 5; at its output (pin 11), a frequency of 200 kHz is obtained.
- The frequency detector (IC3) is based on a 7474 flip-flop. At its clock input (pin 11, IC3), a frequency of 100 kHz is supplied, obtained by dividing 200 kHz by the first flip-flop of IC3. To the input D of the detector (pin 12, IC3), a frequency obtained from the vco, preliminarily divided by 10 in the IC4 counter, is supplied.

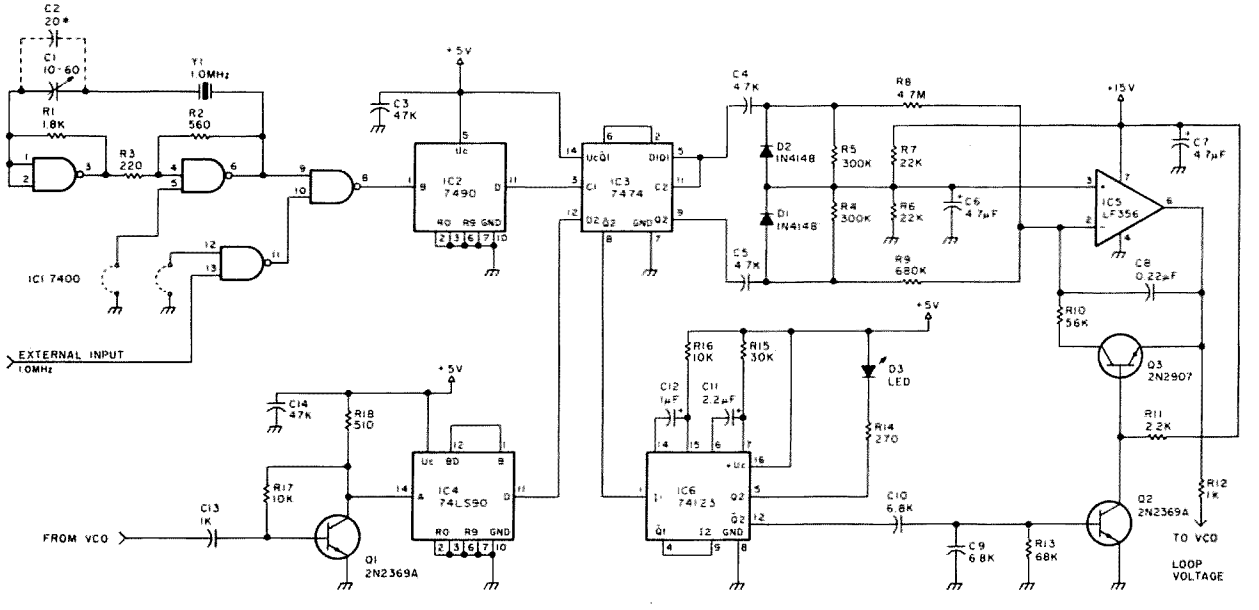


Fig. 4. Digital part of band synthesizer (FLLBS).

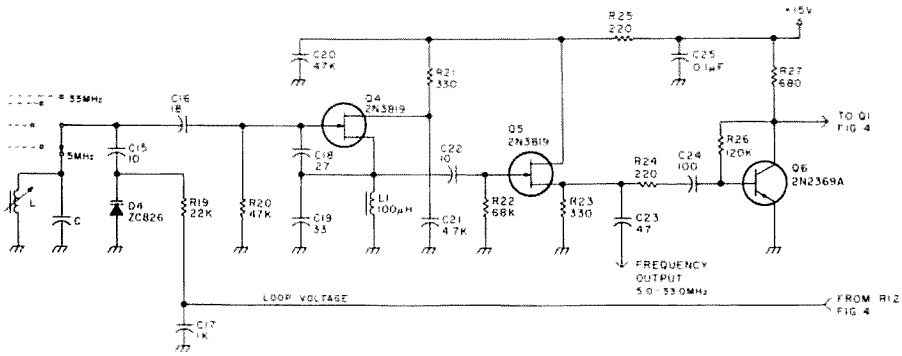


Fig. 5. Vco of band synthesizer.

- IC5 operates as an integrator; due to high resistances in the adding circuit, I constructed it with the use of an FET amplifier with high input resistance.
- IC6 functions as a low-pass filter; it has to detect and signal through the diode LED the state of desynchronization of the frequency-locked loop. Transistors Q2 and Q3 serve to neutralize the integrator when the vco is desynchronized and restore the state of synchronization of the loop.
- Desynchronization often takes place when changing the bands of the vco.
- The vco (Fig. 5) operates in a standard system. For individual operating bands (see Table 1), separate resonance circuits were used, changed by selector switch together with the corresponding input circuits of the receiver. The function of the switch may be also performed by contacts of relays. For tuning the vco, a varicap diode was used. At the generator output, a voltage follower from which the output signal is taken was used. The signal from the follower is amplified by transistors Q6 and Q1 and supplied to the counter from IC4.

Construction and Alignment of the FLLBS

The digital part of the system and the vco were placed on separate printed circuit boards. The purpose of this was to eliminate disturbing pulses from the digital part which could reach the receiver input through the vco. Depending on the actual mechanical design of the receiver, it might be necessary to enclose the digital part of the synthesizer in a shielded casing.

The vco, the voltage follower, and one stage of the amplifier were placed on a plate with the resonance circuits and the band-selector switch. Figs. 6 and 7 show the digital part of the synthesizer. The construction of the vco depends on the type of the band-selector switch used and the coil casing of the resonance circuits. The design of the vco PC board should be worked out individually, depending on the needs.

For the same reasons, I am not giving here the data for the LC circuits for individual bands; they should be selected according to the generally-known principles. All transistors and diodes used in my construction may be replaced by their more recent equivalents.

When aligning the crystal oscillator, pins 5 and 12 of IC1 should be properly connected. When working with a built-in crystal, pin 12 should be connected to ground and pin 5 left free; when using an external oscillator, it should be connected to the proper terminal pins of the PC board and pin 5 should be connected to ground, while pin 12 should be left free.

When aligning the synthesizer, a voltmeter should be connected to output 6 of IC5 and then controlling the vco frequency meter or a calibrated receiver, the vco resonance circuit of the vco should be tuned by means of the coil core to a fre-

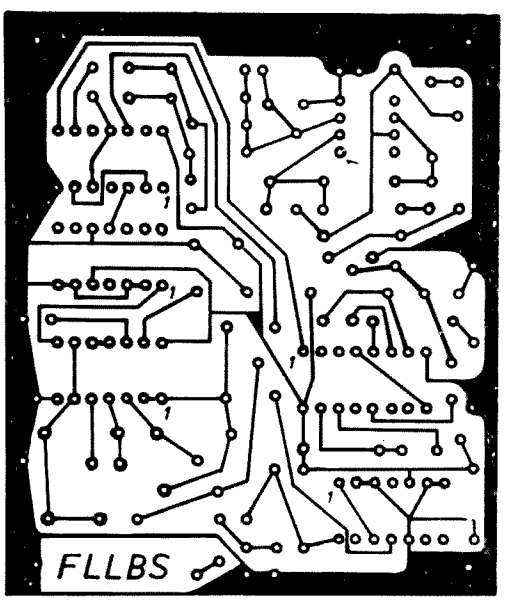


Fig. 6. Digital part of FLLBS PC board (foil side).

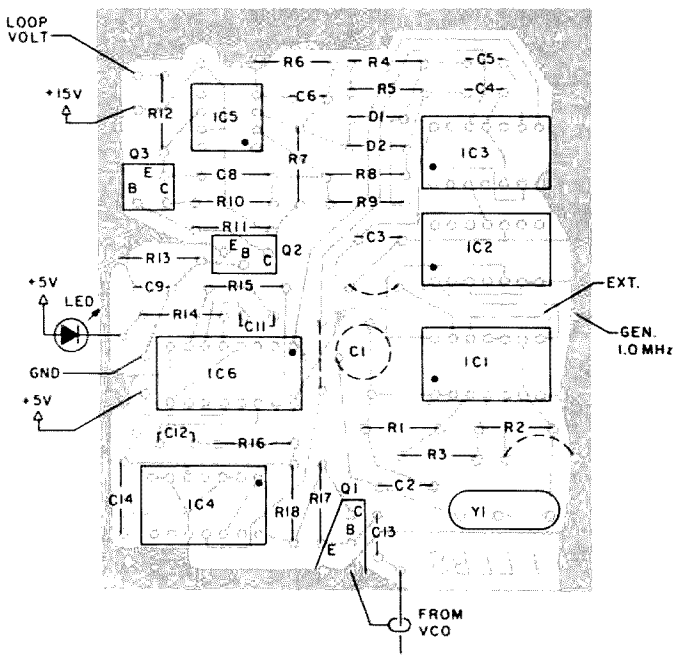


Fig. 7. FLLBS, component placement.



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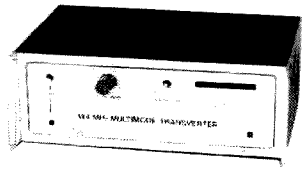
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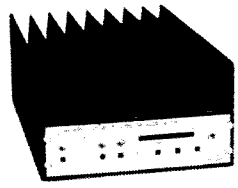
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quency close to the required frequency until the vco is synchronized. When synchronizing the oscillator, the LED should go out.

To obtain a maximum range of loop synchronization, the vco resonance circuit should be tuned in such a way that the voltmeter shows about 11 V. The above method of aligning should be repeated for all operating bands of the synthesizer.

Other Applications of FLLBS

The FLL band synthesizer described above operates with an interval equal to 1 MHz. In case it is used for oscillator stabilization with a different frequency interval, the frequency F_t should be selected accordingly. For instance, in a generator operating with an interval equal to 500 kHz, the frequency F_t should be reduced at output 3 of IC3 from 200 kHz to 100 kHz (IC2 should be changed so that it could divide by ten). No other change is needed.

When the FLLBS is used for oscillator stabilization in the already-constructed equipment, besides choosing the correct frequency, F_t, a varicap diode should be built into the existing oscillator through the correct padding capacity and the resonance circuits should be tuned into the loop synchronization range. The loop synchronization range depends on changes in the capacity of the varicap diode and the value of the padding capacitor, C15.

A capacitor with a relatively low capacity was used here to make impossible any accidental synchronization of the vco with the frequency different by ±1 MHz from the desired frequency. The operation of the vco and its synchronization were tested up to about 60 MHz; synchronization was correct within the whole range. If we want to use the FLLBS for operation at higher frequencies than 60 MHz, IC4 should be replaced with a fast-series IC. Capacitor C15 should be reduced and the vco resonance circuits should be selected and tuned; no other changes are necessary. ■

Parts list

Component	Value	Quantity	Component	Value	Quantity
R1	1.8k	1	C4, 5, 21	4.7k	3
R2	560	1	C6, 7	4.7 uF	2
R3, 24, 25	220	3	C8	0.22 uF	1
R4, 5	300k	2	C9, 10	6.8k	2
R6, 7, 19	22k	3	C11	2.2 uF	1
R8	4.7 Meg	1	C12	1 uF	1
R9	680k	1	C13, 17	1k	2
R10	56k	1	C15, 22	10 pF	2
R11	2.2k	1	C16	18 pF	1
R12	1k	1	C18	27 pF	1
R13, 22	68k	2	C19	33 pF	1
R14	270	1	C23	47 pF	1
R15	30k	1	C24	100 pF	1
R16, 17	10k	2	C25	0.1 uF	1
R18	510	1	Q1, 2, 6	2N2369A	3
R20	47k	1	Q3	2N2907	1
R21, 23	330	2	Q4, 5	2N3819	2
R26	120k	1	D1, 2	1N4148	2
R27	680	1	D4	ZC826	1
L1	100 uH	1	D3	LED	1
Y1	1.0 MHz	1	IC1	SN7400	1
C1	10-60 pF var.	1	IC2	SN7490	1
			IC3	SN7474	1
C2	20 pF if needed	1	IC4	SN74LS90	1
			IC5	LF356	1
C3, 14, 20	47k	3	IC6	SN74123	1

CONTESTS

Robert W. Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CONNECTICUT QSO PARTY
Starts: 2300 UTC April 5
Ends: 1900 UTC April 6

Sponsored by the Candlewood ARA, there is a required rest period from 0500 to 1300 on April 6th. Phone and CW are to be considered the same contest.

EXCHANGE:

RS(T), QSO number, ARRL section or CT county.

FRENOUENCIES:

Phone—3.927, 7.250, 14.296, 21.370, 28.540.

CW—40 kHz from low end.

Novice—3.725, 7.125, 21.125, 28.125.

SCORING:

Club station W1QI counts 5 points, Novice QSOs count 2 points, OSCAR QSOs count 3 points, others 1 point each. CT stations multiply QSO points by ARRL sections worked. CT stations may work DX stations for QSO points and only one multiplier, multiply QSOs by number of ARRL sections worked plus one DX country. Others, multiply QSO points by number of CT counties worked.

ENTRIES:

Include an SASE for results and mail entries by April 30th, addressed to: CARA c/o R. Dillion N2EFA, RFD #7, Noel Court, Brewster, N.Y. 10509.

CARF PHONE COMMONWEALTH CONTEST
Starts: 1200 UTC April 12
Ends: 1200 UTC April 13

This contest is open to amateurs in all countries of the Commonwealth of Nations. Entrants may work other amateurs in the Commonwealth using SSB only, on 80- through 10-meter bands. Work only stations outside your own call area. Each station may be worked once on each band. Entry classes include single-operator stations in all or single-band classes.

EXCHANGE:

RS report and a consecutive serial number, starting with 001.

FREQUENCIES:

3.600, 3.760, 7.080, 14.130, 21.200, 28.480 plus or minus 20 kHz.

SCORING:

Each completed contact will score 5 points. In addition, a bonus of 20 points may be claimed for the first, second, and third contacts with each Commonwealth call area on each band.

AWARDS:

A plaque will be awarded to the top scoring allband entry. Certificates will be awarded to top scorers in each class in each Commonwealth call area.

ENTRIES:

A valid entry must include log sheets, dupe sheets, a checklist of Commonwealth Call Areas worked on each band, and a summary sheet showing claimed QSO and bonus points as well as final claimed score calculations. Summary and call area checklist sheets are available for an SASE. Entries should be mailed within one month of the contest to: Norm Waltho VE6VW, Box 1890, 9714 94 Street, Morinville, Alta, T0G 1PG Canada. Results will appear in *TCA*, the Canadian Amateur Radio Journal. Nonmembers of CARF may wish to include an SASE with their entries for a copy of the results.

SOUTHERN CALIFORNIA SIX-METER CLUB QSO PARTY
Starts: 1200 PDT May 10
Ends: 1200 PDT May 11

The purpose of this contest is to generate and maintain a maximum of activity on the six-meter amateur radio band in any mode or form of communication. It is also to get as many hams as possible to mountaintop operate or otherwise provide strong signals for intercommunication within our area and, hopefully, nationwide.

If a good number of six-meter hams get out and on hilltops on the 10th and 11th of May, it will be quite a showing. Imagine the signals and signal reports of cross-confirmed contacts. Let's all get out or at least get on the air and have a good time. Make it a picnic on as many hilltops or high locations as we can radiate from. With a large contingent of Southern California six-meter hams we will hopefully stir the band up for some good sporadic E layer DX.

SCORING:

Based on one point per mode per callsign. Multipliers based on one per grid square worked.

EXAMPLE:

WA6BFH works N6FSL on SSB, FM, CW, and AM—for this BFH receives 4 points (one for each mode worked), also one multiplier for working grid square DM13. If BFH works K6GSX on all the same modes, he will receive four more points and one multiplier for working grid square DM03.

Key Clucks

NEWSLETTER OF THE MONTH

If you were asked to come up with a name for the Chicken Fat Organization's newsletter, what would it be? *Key Clucks*, of course! (CFO is a loose group of high-speed CW fanatics.) Editor Wayne Renard NZ4W carries the poultry theme to extremes; nearly every page of this newsletter has some sort of chicken on it.

Beneath the feathers lies a style of writing that made NZ4W famous as editor of the Nashville Radio Society's *Rat's Tale*. Wayne somehow manages to take the dull facts of day-to-day ham radio and turn them into hilarious stories. *Key Clucks* is proof that club newsletters can be informative *and* fun.

To enter your club's publication in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Newsletter of the Month.

CALENDAR

Apr 5–6	Connecticut QSO Party
Apr 12–13	CARF Commonwealth Phone Contest
Apr 14	ARRL 144-MHz Sprint
Apr 22	ARRL 220-MHz Sprint
Apr 30	ARRL 432-MHz Sprint
May 3–4	Florida QSO Party
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
May 17–19	Michigan QSO Party
May 27–29	CLARA AC/DC Mystery Contest
May 31–Jun 1	National 6-Meter Invit. Net Activity Day Contest
Jun 7–8	ARRL VHF QSO Party
Jun 28–29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12–13	IARU Radiosport Championship
Aug 2–3	ARRL UHF Contest
Aug 16–17	New Jersey QSO Party
Sep 13–14	ARRL VHF QSO Party
Oct 11–12	Rio CW DX Party
Nov 1–2	ARRL Sweepstakes—CW
Nov 15–16	ARRL Sweepstakes—Phone
Dec 5–7	ARRL 160-Meter Contest
Dec 13–14	ARRL 10-Meter Contest

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

This month's column is somewhat anecdotal. It pertains to all the careful plans that contesters put together for the big one—the January ARRL VHF Sweepstakes—and how, despite your best intentions, Murphy still has plenty of surprises in store!

I've been actively running the January SS for several years now, but have been plagued with all sorts of problems ranging from equipment failures to power line trouble and adverse weather conditions. Every year, despite the numerous station improvements, something "gremlin" rears its ugly head and I'm back to the drawing board. Well, this year was going to be different, with all-new antennas, feedlines, power supplies for the high power amplifiers, and improved transceiving equipment.

I took the perennial line noise problem into account and employed an ICOM 740S with adjustable noise blanker to fight the electric heaters and blankets on 144 MHz. (Believe me, it's no fun trying to copy FM06 through S9+20 dB noise levels!) Not being very active on 50 MHz, I secured the use of an IC-551D for the contest as well as a KLM 7-element beam. The 432 yagi array had been suffering from high swr after heavy rains which I traced to a marginal pigtail, and replaced with a more weather-tight version. A 220 MHz GaAsFET preamp went up on the tower, courtesy of the VHF Shop. What better way to test a preamp than during a VHF Sweepstakes?

I had earlier installed new runs of Prodelin 7/8" Spir-O-Line on 1296 MHz and also put a surplus Adler Electronics cavity amplifier to use for about 65 to 70 Watts of power. The SSB LT23S 1296-MHz transverter was run through a MMT 144/28 transverter into my Kenwood TS-430S, allowing the use of scanning and memory channels for setting up schedules. New tubes and capacitors went into the 432-MHz power amplifier to improve its reliability and every switch in the station was clearly labeled, for a change. (This latter part is very important, especially when you are frantically jumping from one band to another to make skeds on the UHF bands!)

Having completed the improvements to the station hardware, I turned to creature comforts. My shack is in the basement in an unfinished room, and the walls and floor are concrete. This is fine in the summer on a hot day, but makes an excellent refrigerator in the wintertime! A space heater in the right place took care of the heating problem (yes, it was prechecked for line noise) and I added several layers of foam insulation under a couple of pieces of carpet to keep the feet warm. A nice wooden chair with arms was selected for the long late night hours, and I installed low-angle lighting with 25- and 40-Watt bulbs to avoid eyestrain.

The last area needing attention was the logging and duping position. I secured the use of a Hewlett-Packard HP 110 minicomputer with companion disk drive and printer from Charlie Rothschild WB2INB. Charlie has developed a very nice logging and duping program that runs on HP and IBM/IBM-compatible systems, and our club group SCORE has used it many times during our multi-multi contest efforts. The 110 uses an LCD screen and is well engineered for human comfort while typing. The computer was set up next to the main 144- and 50-MHz stations, with the printer and disk drive on the side table for duping and backing up the memory during breaks.

The addition of a footswitch and selector to assign it to the three main transceivers allowed me to remain in one position. The output of the sequencer box also went to a four-position switch to key the 220, 432, 432 tube, and 1296 power amplifiers—again, all at the flick of a switch. Of course, the transverters on the TS-430 could be switched from 220 to 432 or 1296 through a selector panel, as could the CW keyer! My final act of laziness was to install another rotor with the 50-MHz beam and a second 32-19 Boomer for 144 MHz. This way, I could jump 180° at the flick of a coax switch to work stations calling me off the back of my primary antenna. (This isn't a new trick. Steve WB2WIK and others have used it for years. If you've got a few extra dollars and the tower space, it makes your 2-meter contact rate stay up there!) These modifications completed the upgrade of my station to make it contest ready.

Finally, all was ready. I'd booked the date in my calendar and the XYL made sure we had no plans for the weekend. (We actually did, except we didn't know it at the time. More on this in a moment!) The appointed hour rolled around on Saturday and at 2 pm KT2B was on the air on 50 MHz with 80 Watts.

It became apparent quickly that my 6-meter station wasn't going to make a big splash in the contest. Sure, the 80 Watts and the 7LD beam worked fine, but anything over 100 miles away was going to be VERY hard to work. The beam was installed at 30 feet, which is hardly optimum for 6 meters. But it was the only place I could install the beam, so I figured if I could add another 10 to 20 multipliers, it would be worth the trouble.

The IC-551 has a decent receiver but really needs a good preamp in front of it, so out came the JANEL MOSFET preamp that Mike Crawford WA2VUN had loaned me with the rig and beam. Only problem was we had blown out the MOSFET in June of 1984 during the June VHF QSO Party and he neglected to tell me that (or forgot). Out came the soldering iron and a new 3N204, and after a 15-minute delay I was back on the air. Some interesting prefixes were bagged during this period (nothing exotic) and I worked about 35 stations before turning to 2 meters.

Aha! Now this was more like it. The combination of the two Boomers—the main at 45 feet and the second at 35 feet—worked very well. With my 200-Watt MML amplifier (reviewed in March, 1986, *73*) I was able to start piling up the contacts right away. In short order I worked 70 or 80 stations and 10 grids! The 2-meter setup was working better than I had hoped. After several hours here, I broke for dinner and planned to attack the higher bands.

Soon I was back on 50 MHz checking for more new contacts and quickly added about 10 more before some incredible buzz in excess of +30 dB wiped out the front end of the IC-551D. Another electric blanket, probably. I jumped up to 220 MHz to see what was happening and fired off a few more contacts and grid squares—among them my first ever contact with FM28 on 220 MHz. We quickly jumped up to 432 to duplicate the contact, then to 144, and finally 1296 MHz (no luck). No matter! The station was really hopping now. I was finally appreciating all those hours of hard work during the summer and fall! 432 yielded more contacts and grids, including several in Maryland and southern Virginia. 1296 was even more fruitful with contacts into Maryland and northern Virginia. A quick check back on 144 MHz yielded many more contacts as stations wandered onto the band.

I took another quick break at 10 pm and went upstairs to grab a snack. My wife was looking a little funny and mentioned that she was having mild cramping sensations that evening. Unusual? Not if she's eight months pregnant. It seemed too early to be thinking of a baby! I had this strange sense of impending doom but shrugged it off and went back to work.

By now I was bouncing back and forth between 144 MHz and 1296 MHz (10 to 11 pm is the 1296-MHz activity hour in these parts) and working lots of stations. The total contacts were well over 200 and the grids in excess of 40 on all five bands. Not bad for 300 Watts on 144 and 432, 100 Watts on 50, and 220 on 70 Watts on 1296.

Activity tapered off on the higher bands so I went back to work on 50 and 144 MHz until about 2 am, when I decided to call it a night and get a few hours shuteye. I had made 250 contacts and 52 grids—decidedly better than my previous year's totals at the halfway point. In fact, I was running about double last year's score and well expected to break 500+ QSOs and 80 grids.

I knew I was in trouble when I came up to the bedroom and my wife was bent over on all fours on the bed, breathing slowly and looking at the clock. You guessed it! Her contractions had started and she was into active labor! I especially liked her comment as I came through the door: "I don't think you'll be going back on the air again this weekend!" To make a long story short, she indeed did wind up going to the hospital the next morning and by 5 pm we had ourselves a healthy 6-pound 5-ounce boy, three weeks early, and I'm sure it was because of my carefully laid contest plans! As she was wheeled into her hospital room, I pondered the meaning of it all. This had to be Murphy's

biggest prank ever, after all the blown GaAsFETs, shorted power supplies, and constant line noise. He's a resourceful guy! Makes you really respect him as an opponent. (And no, I didn't name my boy after him!)

As 8 pm rolled around, there was nothing left to do but go home, as Gayle was tucked away safely in her hospital bed, while Ross Lewis Putman was the subject of much admiration and attention of the nurses. Feeling like a fifth wheel, I was about to leave when my shocked ears heard my wife say "Gee, there's still a few hours left in the contest. Why don't you go home and operate them? It might relax you!" She had a point. Even though I hadn't had any sleep since early Saturday morning, the adrenalin was flowing like the mighty Mississippi. What the heck! A quick stop at Burger King, and I was home again, warming up the rigs.

News spread fast, especially when you've got guys like Steve Katz WB2WIK and Ivars Lauzums KC2PX in your contest club. I think every fifth contact included a "Congratulations, Dad!" with the grid exchange, not to mention a few expressions of surprise that I had actually bothered to get back on the air. Well, you just can't keep a contester down, and at 11 pm I pulled the plug with 290 QSOs and 58 grids for my efforts. It wasn't what I was hoping for, but I'll take it. . .

AM-6155 update: Well, Fair Radio is still out of stock on AM-6155s but is now getting rid of their AM-6154s at a fast rate. Many readers have called with questions on how to modify these radios for 2-meter operation! As they come from the box, they will tune the 144–148-MHz band, although you'll only see about 50–60 Watts out for 10 Watts of drive. I do not have any specific information on modifying this unit and would welcome it from readers who have done the mods. A suggestion might be to work from the 144-MHz mods to the AM-6155 from last month's column, as the plunger is reset on the 6155 to get 2-meter operation. The plunger on the 6154 is already set for it, so the grid compartment will have to be tweaked up. Basically, there are three places that will require attention: C1, the input coupling capacitor needs to be increased in value to about 10 pF. C2 and C3 will also have to be increased to about 30 pF and 100 pF respectively. (Refer to the schematic in the March column.) The existing output tuning circuits need not be modified to result in about 300–500 Watts with 1–10 Watts of drive, depending on how tightly you couple the input.

Again, I could use input from you readers. Send along your schematics and notes and I'll publish them posthaste. Incidentally, I ordered one of the #A5-TUN-CAV assemblies from Fair Radio and it showed up today, so I'll give a brief report on what I've found out so far: The unit does contain a 4CX250B and also contains a type 6816 tube, which won't be used. The input connector is a type SMA, and the hole it's in can be drilled out to take a BNC or N connector. The ouptut is type BNC and can be left alone. There are several adjustments, including a "PA FREQ ADJ" control, which resonates the cavity, and an output coupling control next to the tube using a flapper. The output of the 6816 also has a tuning control which could be used to resonate the grid of the 4CX250B.

Some kind of input grid circuit will have to be made up and I'll pass along my notes on this as I proceed. Although there is a hole marked "VHF-UHF PA BAND SWITCH," there is nothing in it so the cavity is tuned for one band range. I'll determine that also by the next column, but most likely it's set up for around 200 MHz. This unit also needs a blower and power supply voltages of +2000 VDC, +360 VDC, -135 adjustable VDC and 6.0 VAC for filaments. This might turn out to be a nice amplifier assembly, especially if you've got the power supply already built up. A single 4CX250B on 220 MHz should be good for around 300–400 Watts output with 2–6 Watts of drive. The cavity might also make a good repeater amplifier. The cavity design lends itself to a HI-Q tuned circuit, important in repeater installations to avoid desense. And 4CX250's are rugged and easily replaced. You can often find them at flea markets for as low as $10 apiece. Contrast that with 8930's which retail brand new for over $130!

READER INPUT DEPT.: Aside from the usual letters asking for more information on Fair Radio Amplifiers, I get newsletters from radio clubs. One of the strangest and funniest I've seen comes from the Pittsburg Repeater Organization and is called (appropriately) the PRO-Crastinator. Published by KC0ES, George Willard, it's a loose collection of local news, excerpts from the W5YI Report, and some funny articles on topics of general interest. This month's deals with the absurdities of mathematics in which the author proves that among other things, everything is white, and Alexander the Great did not exist while having an infinite number of limbs. What does this have to do with amateur radio? Beats me but I laughed pretty hard when reading the newsletter.

The Southern California Six Meter Club is sponsoring the Southern California Six Meter QSO Party on May 10 and 11. The purpose is to generate and maintain high activity levels on the six-meter band using any mode of communication. It runs from noon till noon PST, and entry forms are available from the club. Write them at: PO Box 448, Cypress CA 90630.

In future columns, I'll be discussing power measurements and tackle the subject of swr and what it means to you on the VHF and UHF bands. I'm also working on getting one each of the IC-471 and TS-811 multimodes for a side-by-side comparison in the lab. Many users of the 432-MHz band want full coverage of 430–450 MHz with the ability to work SSB, CW, and FM repeaters, as well as the OSCAR uplink. These rigs are full-featured and both will set you back a nice big piece of change. How well do they really work? Are they worth the investment? I'll try to have both qualitative and quantitative answers for you in the next few months.

Look for reviews of the new EME VHF/UHF wattmeters from Germany, including multiband models with coverage from 144 MHz all the way up to 2304 MHz. Also, more new transverters from Microwave Modules and SSB Electronics, as well as the Microwave Modules ATV transmitting and receiving converters. There're plenty of products out there for the VHF/UHF enthusiast and I'll try my best to have a look at as many as I can get for you. If you're out at Dayton this year, why not stop by the PX Shack booth and we'll have an eyeball QSO! Until next month, see you above and beyond!

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

I don't do this often, but in the spirit of this month's holiday, I hope you'll bear with me.

In the beginning, the Teletype Corp. created the Model 12, and it was good. Next came the Model 14, and it was good. Then came the Model 15, and it, also, was good. Soon thereafter came the Model 19, and it was *very* good. And then came the Model 28, and it was *very* good, indeed! But then came the Model 33, and it was the best yet. Ouch!

Well, you get the idea. Here I am with notes from many of you about the Teletype Model 33. Major Gene Pfeiffer of New York asks to be counted in, "at least 10 votes. I would like to do away with all unnecessary components. . . all I need to know is where I can cut in the external loop to drive the keyboard."

Louis Hutton K7YZZ of Bellevue WA is another ham who has tried to hook up a Model 33 to a computer. He has "been able to successfully modify the TTY to run from TTL ouput signals from the CoCo's serial I/O port. But like anything you try, there are problems."

Down south, Bob Furlong WD0CBN in Miami FL would like to hook up his Model 33 to use as a slave printer for his setup. He cautioned me in his letter that he has only "put together Heathkit projects and simple one-tube receivers, but I will give anything a try." That's the spirit, Bob!

Ted Malafouris W9OVZ in Howell MI has used some of the information presented here before to hook up his Model 33 to a receiver, but says that all he prints is "garbage." Well, Ted, I'd like to remind you that the 33 is an ASCII-encoded machine, and most amateur transmissions remain Murray (5-level) encoded. Also, there is

tremendous variation in what FSK signals you'll encounter when tuning across the HF spectrum. Don't be discouraged—hopefully some of the material presented this month will help.

Andrew Janer WA1VRZ in East Haven CT is an ambitious soul who hopes to hook up a Model 33 to a Timex computer. We aim to please, sir.

The Teletype Model 33 teleprinter is either an electromechanical marvel or a nightmare, depending on how you look at it. Using a typing cylinder, kind of a "squooshed" Selectric ball, it chugged along at 110 baud—equivalent to 100 words per minute, ASCII code, uppercase only with a "Teletype standard" 72-character line length. Despite these limitations, many of these monsters found their way into amateur radio stations.

Interfacing the Model 33 is made difficult by the fact that there is no single standard version of the 33, but a variety of options contained in a panel on the right side of the machine, the Call Control Unit (CCU). Various CCUs were manufactured (the Model 33 is not out of production) for line service and telephone systems, as well as for computer interfacing. If you can get it, the I/O 33 is the easiest of all to interface. This CCU is identified by six push switches along the front of the CCU labeled MOTOR OFF, REMOTE, REQUEST, EOM, LOCAL, and PUNCH. Usually, that is. . .you see, there are different ones, too. And you can't always tell a CCU by its buttons.

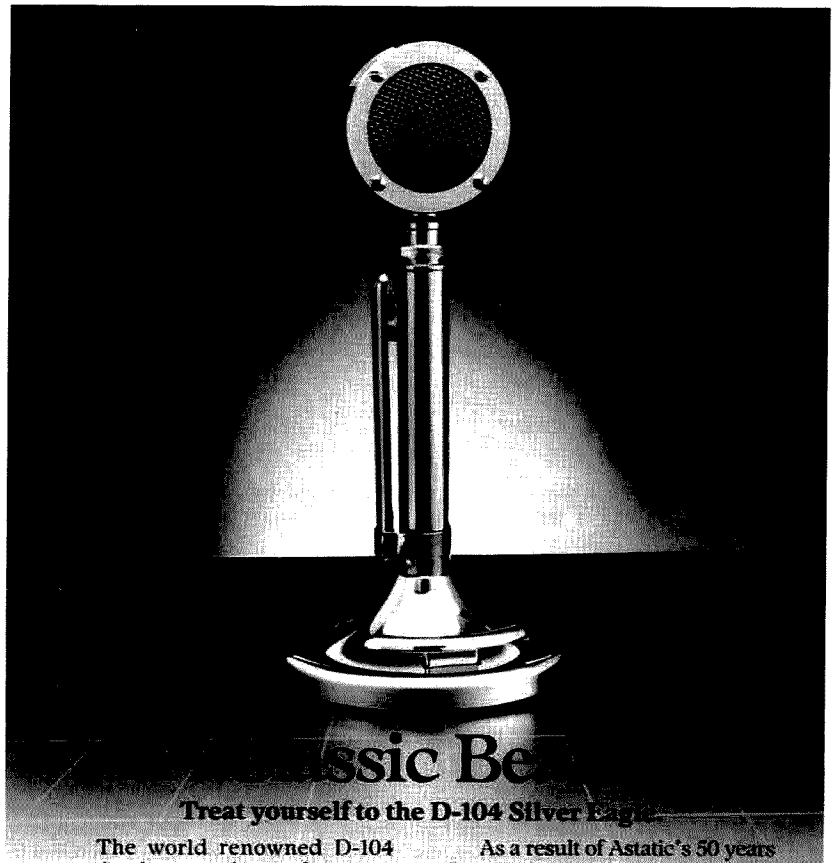
Anyway, if you have one of those, you'll find a terminal strip inside, at the rear of the CCU. On mine, it was mounted vertically under the bank of Molex® connectors. On yours, who knows? If you have one like mine, connect the brown/yellow and white/blue wires to terminal 5, and the violet wire to terminal 9, and move the blue wire from the 750-Ohm tap to the 1450-Ohm tap on the power resistor behind the power supply inside the teleprinter. Then connect the interface through the connections shown in Fig. 1, after first checking for unwanted voltages and the like.

If you're a trifle less than brave, as I am (not), you might be interested in the circuit of Fig. 2. This is a scheme to use an optoisolator, such as a 4N35, to isolate the computer or interface from the deadly voltages that may be lurking around the Model 33. I highly recommend such isolation.

Let's say that you have one of those Model 33s that isn't equipped with an I/O CCU, now what? Well, you still should have the terminal strip, often labeled 151411, at the rear. If you lack that, trace out the wires coming from the selector magnets. They should enter a printed circuit board, the Selector Magnet Driver board. Pin 6 from this board should be ground; pin 11 is the signal input.

The wire going to pin 11, by the way, should be coming from the transmitter distributor. That means the keyboard signal should be available there. Again, if you have a custom-wired 33, all bets are off, but you should be able to trace out the wiring and go from there.

Assuming you have been able to identify the proper leads to connect to, and have interfaced the 20 mA TTY loop with the more



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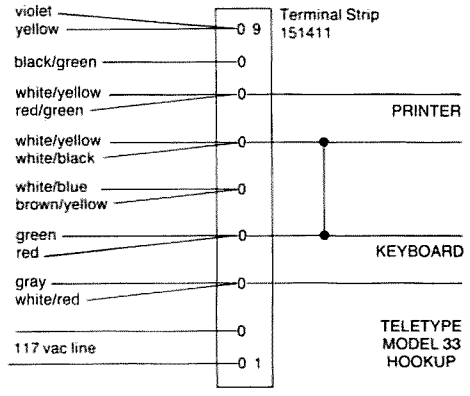


Fig. 1.

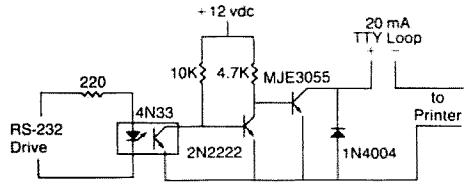


Fig. 2.

common RS-232 levels of a computer interface, all that is left to do is make the computer speak 110 baud of ASCII. The ASCII part should be easy; it's the native language of most computers. As to the 110, it depends on the computer. We covered the CoCo in this column several months ago. Program 1 is a simple scheme to allow the CoCo to output at 110 baud through the "bit banger" serial port on the rear apron. Similar schemes should be just as easy for other computers. Even my old 6800 would slow down with the flick of a jumper.

I hope this material will help those of you who have been trying to get a Teletype Model 33 interfaced. Remember to measure all points for dangerous voltages *before* you hook up the computer. I don't mean you should take the "smoke test" literally! And please, let me know your experiences.

Moving right along. . . I have asked for some opinions, now and then, on a variety of RTTY topics. One of them has been packet radio. Are you interested, or will this be the NBVM (who remembers that one) of the future?

Wendell Larsen W3IRX of Upper Black Eddy PA has taken the challenge. Wendell says that he is "currently on HF and VHF RTTY with an IBM PC and Hamcom software" and has been contemplating getting on packet. No one yet has satisfactorily clarified his questions about this mode.

Wendell writes, "Essentially, what does it provide to justify the cost? Supposedly, it will enable countrywide 2-meter digital communication capability. I question this since it appears difficult, if not impossible, to establish effective links, at any time, even on the East Coast. I really can't see how error-free communication is possible if the link cannot be established.

"Now, packet operation on HF may hold some possibilities for point to point without intervening digi-peaters. I'm constantly hearing local 2-meter packeteers enthusiastically proclaim that they made it as far as New York or Florida. Even then, the path was so cluttered that nothing practical could be accomplished."

Well, Wendell, from the packeteers I've talked to, it sounds like we are looking at two different systems! I don't know what the closest digi-peater is in Upper Black Eddy PA but here in Baltimore establishing a link with a machine doesn't seem to be much of a problem. Now, I grant you, what hams talk about on packet is not likely to be any more stimulating than what hams talk about on RTTY, FM, SSB, AM, or CW. I am leaving ATV and SSTV out of this because they at least have pictures.

But the mode itself promises great potential, with the proliferation of digi-peaters. I think back to my early days on 2 meters. On AM, getting a signal from Silver Spring MD, a suburb of Washington DC, into "the District," (as residents term DC) was a real thrill. When the first FM repeater was established midway between Baltimore and Washington, I drove to a hill near my home to try to make the repeater, and with it, Baltimore. Now, 2 meter repeaters are so common that sitting here in my den I can pick up a handheld two-meter rig and trigger five or more machines, with a geographic range of Washington DC to York PA.

This is the ground floor of packet'dom. If it takes off, it won't be for present convenience, but for future promise. Let's hear what others have to say on the subject. We all would like to know.

Regards to David Berger WD6EUC of Sunnymead CA. David has joined the ranks of C-64 owners, and is looking for a way to put his computer onto RTTY. Well, David, I hope the review of C-64 and VIC-20 software covered here a few months ago was a help to you. I also suggest that you ask around at your local ham club for someone who uses this setup. The C-64 is a popular small computer, and I am sure that you'll find someone in your area who is using it on RTTY. Let me know how you make out.

Another fan, Jerry Valentini KC2IO of Jersey City NJ is running a TRS-80 CoCo, and is looking for a disk-based program to run RTTY. Well, sorry to say, Jerry, not much is available commercially at this time. A scheme was presented here a few months ago to convert Clay Abrams' program, NEWRTYCW, to at least load from disk, and I have sent that along to you. Hope it helps.

Jerry also asked about keyboard replacements, a topic that I have addressed for several computers. Well, if you can find it, the fabled $5 Radio Shack replacement keyboard certainly represents the best value per dollar ratio. You can identify it by the red BREAK/ESC key in the upper right corner, an ALT key next to the Q, a CTRL key next to the A, the CLEAR key next to the @, and the cursor arrows relocated to a diamond configuration on the right side of the keyboard. It also sports two function keys, labeled F1 and F2, at the lower right. If you can't find that one at Radio Shack, don't buy any of the other Radio Shack keyboards; they were made for a variety of other computers, and won't fit the CoCo.

Instead, you'll have to choose from the $5 keyboard being sold at a higher price, as advertised by several national advertisers, or one of the "expensive" keyboards that cost more than $50. At that point, it really becomes a matter of personal preference. To get a feel for typing on one, see if anyone near you owns any of the replacements. Good luck.

As you can tell, many of the folks writing in this month were helped by material presented in this column in the past. Many of the more requested topics are in the reprint series I have put together. A list of reprints, each of which is available for a self-addressed stamped and $2 to cover costs, can be had for the SASE alone. Just send it to me at the address at the top of this column, and ask for the list of available reprints. I always welcome questions, of course, and try to answer them in the column as soon as possible. If you want a personal response, be sure to include that all-important SASE. I can also be reached on CompuServe, ppn 75036,2501, either on EasyPlex or often on the CoCo SIG (GO COCO).

Topics are flying by these days, and next month promises to be a winner. Be sure your subscription to *73* is up to date; you wouldn't want to miss next month's RTTY Loop!

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10 ' 110 BAUD OUTPUT THROUGH
20 ' COCO SERIAL PORT
30 ' RTTY LOOP—APRIL 1986
40 ' MARC I. LEAVEY, M.D. WA3AJR
50 POKE &H954,&HO1:POKE &H96,&HF6:'110 BAUDS
60 POKE &HFF23,&H30:' THESE POKES
70 POKE &HFF22,&HF9:' DISABLE THE
80 POKE &HFF23,&H34:' PRINTER HIGH
90 POKE &HFF22,&HOO:' SIGNAL REQUIREMENT
100 END
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Program Listing 1.

REVIEW

SSB ELECTRONICS PA2310 POWER AMPLIFIER

SSB Electronics of Iserlohn, Germany, is an up-and-coming manufacturer of many quality products for VHF and UHF enthusiasts. The company also offers a full complement of receive converters, transmit converters, transverters, and amplifiers for microwave enthusiasts. The PA2310 is a solid-state amplifier for the range of 150–1300 MHz, which operates from 13.8 volts and allows SSB, FM, or ATV operation.

Ordinarily, a low-power monoband UHF amplifier might not warrant much attention; however, there are very few available in the medium-power range for 23 centimeters. There are several transverters on the market for this band, but most of them are limited to 1 to 3 Watts output. The PA2310 complements those transverters, especially since it requires only 500 to 750 mW of power to attain full output.

Another reason it's handy to have 10 Watts of power here is that most outboard high-power 23 cm amplifiers utilize 2C39/7289/3CX100 type tubes, operating in grounded grid configuration. These amplifiers are usually good for 10 dB of gain in this mode, so 10 Watts of drive will usually yield 100 Watts or so of output. Use two of these tubes and you'll see close to 200 Watts output. The PA2310 fills the gap nicely as an intermediate driver stage, so you will see 100 Watts or more of output instead of 10 to 15 Watts using just the transverter.

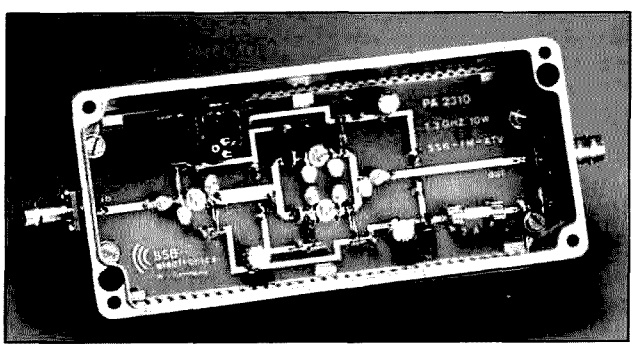
The photo shows the unit with its cover off. The circuit is simple and employs three type BLU90's —one as a driver and two as finals. The output circuit is the usual etched microstrip type. Bias is set by the pot in the upper left corner. Note that there is no provision for standby operation, although you could incorporate it if needed. The amplifier operates in grounded-emitter mode and gain is typically on the order of 6–7 dB per stage.

SSB Electronics rates its amplifiers at 14.5 V dc, which is apparently common practice in Europe. How did this model do? With a Bird Model 43 Wattmeter and 25G slug (25 Watt, 1.1–1.8 GHz), I measured exactly 10 Watts output across a Termaline 50-Ohm dummy load. The driving source was a Microwave Modules MMT 1296/144, which was throttled back to about 500 mW output; the source voltage was 13.8 volts. Raising that voltage to 14.5 volts resulted in about 12 Watts of output power. Lowering the voltage to 12.5 volts dropped the output to 8 Watts.

In actual operation, I used this amplifier on Slide Mountain in June of 1985 with the MMT 1296/144. Our power source was a motorcycle battery, which started out at almost 14 volts and dropped to about 13 volts when we concluded our operation. The amplifier ran cool at all times. The heat sink should be adequate for 1296 ATV operation; however, I'd recommend reducing the drive and keeping the output power at 8 Watts or so in this mode. Note that the BLU90 transistors aren't swr protected, and there is no ALC circuit in the output. You must take caution not to load them into an swr of 2:1 or greater—otherwise, you might be waiting a bit for replacements from Germany. (At this time, there are no sources for this device in the United States.)

In my home station, I mounted a Dow-Key 12-volt coaxial relay atop the amplifier chassis. This amplifier switches the antenna lead from amplifier to transverter antenna input and also turns the dc power on and off to the PA2310. Again, some sort of switchable bias could be used and would accomplish the same thing.

All in all, the PA2310 is an excellent medium-power, reasonably priced amplifier for 23 cm. *Price: $300; U.S. distributor: The VHF Shop, 16 S. Mountain Blvd., Mountaintop PA 18707.*



The PA2310 solid-state amplifier with its cover removed.

55-ELEMENT ANTENNA FROM TONNA

Now that you've got some power on 1296 MHz, you'll need a good antenna to make the most of it. Along comes Antennes Tonna of France with a new wrinkle for 23 cm: a 55-element long-boom yagi. The boom is 15-feet, three-inches long and the manufacturer claims 21.25 dB gain over an isotropic dipole. Now, that's a lot of antenna!

The antenna comes completely disassembled with the various elements and holders in separate packages, unlike the 432 Tonna yagis that come largely assembled. But *don't* let the apparent complexity of the antenna scare you: Tonna has carefully color-coded the ends of the various elements so you can tell them apart. The elements themselves are made from #10 enameled wire that is filed flat but still quite sharp, so be careful. Select the elements by their color and push them through the one-piece molded element holders. You'll need a ruler, preferably one with a metric scale, to center the elements.

I have assembled two of these antennas and they both took about 2 hours of careful work from start to finish. Tonna includes an extra element in case you bend or break one. This *extra element is* as long as the reflector. As with all Tonna antennas, the drive element is a sealed dipole with a supplied RG-213 pigtail. On every Tonna antenna I've ever used (and that includes five 432 MHz 21-element yagis and four 1296 MHz 23-element types) the dipole-driven element exhibits better than a 1.2:1 match in the desired bandwidth. Not only is this an excellent matching system, but it's also very durable. There are no mechanical joints to corrode or work loose, and I wonder why more manufacturers don't use it.

You'll notice that the antenna comes with two boom braces. One problem with 23 cm yagis (and higher frequency yagis) is that the antenna mast support usually is a significant portion of the element length, and a 2-inch mast in front of one of these directors detunes the antenna quite nicely. Tonna recommends either mounting the antenna on top of a mast section, or using an outboard sidearm with the boom attached to the mast at its end. Since the elements stand off from the boom, mounting the boom at mast end ensures that the elements are sufficiently clear of the boom and mast. The top clamp makes this attachment, and the second, lower brace and clamp serves to level the entire antenna. As you might expect, the boom exhibits a bit of sag.

Once the antenna is assembled, you will probably have to break the boom at least in half to get it out of the door! I forgot the boom length and assembled the antenna inside forgetting that my door wouldn't allow the clearance to get it out!

The next order of business was to verify the claimed gain spec. Steve Katz WB2WIK of *CQ* magazine also received one of these monsters for evaluation, and he suggested we pool our efforts to set up a test range in which the gain figures could be verified. Steve did some research and came up with a formula from the publication "Technique of Microwave Measurements," from the M.I.T. Radiation Laboratory

$$G^2 = \left(\frac{4\pi R}{\lambda}\right)^2 \frac{Pr}{Pt} \quad \text{OR} \quad G = \frac{4\pi R}{\lambda} \sqrt{\frac{Pr}{Pt}}$$

G = Gain expressed arithmetically (not in dB)
λ = Free space wavelength in units
R = Range of separation of antennas in same units λ

Fig. 1. Formula for calculating gain of either of two identical yagis.

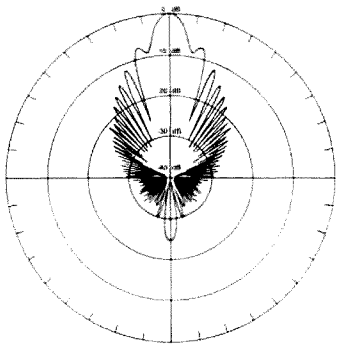


Fig. 2. The nomograph for the H-plane of the antenna.

series. The formula calculates the gain using two identical antennas that are a known distance apart. The formula is given in Fig. 1. Basically, all you need are two of the same yagi antennas and the ability to measure the distance between the two, as well as the power delivered to one antenna and the received signal from the other.

We set up the two 55-element yagis so that the front-most directors on each yagi faced each other at a distance of 75 feet (100 wavelengths at 1296 MHz). Using a Kenwood TR-9000 and SSB Electronics LT23S Transverter as a signal source, a Bird 43 wattmeter was put in the line right at the RG-213 pigtail, meaning it was about 1.5 feet from the dipole-driven element. At the receiving antenna, we mounted a Boonton 92 rf millivoltmeter with 50-Ohm probe and lots of Bunji cords. The power output was set at 5 Watts on the Bird 43 and allowed to stabilize for a few minutes. The rf millivoltmeter was also warmed up and set to the +20dBm range. Steve then swung the receive antenna back and forth slightly to peak the indicated output. At this point, the measurement taken from the millivoltmeter was +13.5 dBm (22.4 mW).

Plugging this into the formula resulted in a figure of 265.98 for both antennas. One antenna would exhibit 3 dB less, or half the gain: 132.99. Expressing this number as gain in dB would be 10 $\log_{10}$ 132.99, or 21.24 db. The manufacturer claims 21.25 db. Close enough for you? I would assume from this that Tonna's gain figures probably aren't overrated.

The pattern is very sharp. Fig. 2 gives the nomograph for the H-plan of the antenna. The 3 dB beamwidth is claimed to be about 11 degrees. The nomograph and our experiments would bear this out. The 55 element F9FT is a sharp antenna, and while it exhibits a considerable amount of forward gain, the sharpness of the pattern might make it unwieldy for the average 23 cm operator. Still, if you understand the antenna and its advantages and disadvantages, it can make the difference for your 1296 MHz station. For example, the K3YTL contest group used eight of these during the recent September VHF QSO Party and worked 65 stations on 23 cm. It definitely works!

The Tonna 55-element antenna costs $70. *US Importer: VHF Shop, 16 S. Mountain Blvd., Mountaintop PA 18707.*

Peter H. Putman KT2B
Morris Plains NJ

MV 220 MAST MOUNTED GaAsFET 220-MHz PREAMP

SSB Electronics of Iserlohn, Germany, has become the first European manufacturer to come out with a commercially available mast-mounted preamplifier for 220 MHz. The 220 MHz band isn't available to Europeans and this represents an unusual bit of marketing on SSB's part. How much of a demand is there for 220 preamps? Only time will tell, but this is a big step in the right direction.

Based on the popular MV series preamps, the MV 220 is basically a reworking of the MV 144 mast-mount preamp. Employing a single GaAsFET, the manufacturer claims in excess of 16 dB of gain. This is considered a 1 kW through-line switchable preamp, and although the unit has its own rf vox type sensed keying, SSB strongly urges use of its companion sequencer when running high power levels.

I've always admired the rf and watertight cases in which SSB makes their preamps. A small gasket runs around the lip of the cover to keep moisture out. You'll need to make three connections: antenna, transceiver and dc power. As with all SSB preamplifiers, the coaxial relays switch in when power is applied. This protects the GaAsFET in case of power loss, or in the event of strong lightning storms. You just cut the power and it's out of the line.

Threaded studs are attached to the case, so you can bolt the unit directly up to a 2-inch mast. A small piece of tubing and gasket serve to waterproof the dc power connection cable, which you must supply. Installation is simple and takes only minutes. I used this preamp with my existing ARR sequencer for keying, and had no problems with false keying, although water got into one of the pigtails and froze, creating a high swr condition. It made no difference to the preamp as the GaAsFET percolated happily along.

On-air tests were impressive. 220 MHz is a sparsely populated band, and quite often the only signal you hear on it is weak and some distance away. In this case, the preamp makes a big difference, especially on signals with lots of QSB. In many cases, my basic 220 transverter—a "Canadian" Microwave Modules 220-28—couldn't even detect the signals that came up to S3 with the preamp switched in, largely due to the noise figure of the 220 module—around 2-2.5 dB. When working stations with rapid fading or flutter, the difference between hearing the conversation and hearing big gaps filled with noise was this preamplifier.

Okay, so it worked. But how well? Back to the lab: Using Hewlett-Packard test equipment, I measured the gain, minimum discernable signal (MDS) and 1 dB compression point. On-air tests indicated that this preamp had lots of gain, and the measured figure of 23.2 dB at 220.00 MHz certainly confirmed it. No doubt, this is one of the hottest preamps around—if you go by gain alone. What about MDS? In my tests, a signal of −140 dBm was detectable using a 1 Khz bandwidth. Pretty sensitive. A signal level of −130 dBm gave us a 10 dB S+N/N ratio, so it certainly hears the weak signals, not to mention putting my MMT 220 to shame. Well, what can you expect from a MOSFET at 220? A noise figure of 2.0 dB is not shabby.

I was surprised during the 1 dB compression test. This preamp does have lots of gain, and on-air tests indicated that the strong signal from Channel 13 was pumping the preamp adversely. By "pumping," I mean a general hash and splatter of intermod products head up and down the 220 band when my yagi was pointed towards New York City. Without the preamp, these products were unnoticeable. Incidentally, another preamp I use here (ARR 220 VDA) exhibits the same problem, but to a lesser degree. It uses a MOSFET and also has less gain. I didn't get to verify its 1 dB point but the SSB MV 220 came up short at -3.5 dBm out. What this means is that the preamp is likely to have trouble with strong local signals, on adjacent channels (and even on an adjacent TV channel) to the detriment of the weak signal you are trying to hear.

This isn't the first time I've observed a low 1 dB compression point on an SSB product. Another MV 144 preamp exhibited much the same number, but had lots of gain. Perhaps the compromise between gain and compression point still needs to be worked out by the folks in Iserlohn. Incidentally, the gain centers on 225.00 MHz, so this preamp could be employed for weak signal FM work as well on 223.50 with good results. In fact, the preamp still had 10 dB of gain at 210 MHz and 233 MHz—which is pretty broadbanded!

For those with a preponderance of weak signals on 220 to choose from, this preamp might make the difference. If you live close to TV channels 12 or 13, you may find the "pumping" problem to be a bit of a headache, but there is a provision to adjust the gain internally by means of a potentiometer. This pot is located at the input to the preamp and is part of a resistive attenuator network. The total attenuation is on the order of 5 dB. I haven't had a chance to use this control, but would be tempted to replace it with 10 dB of fixed attenuation and run the preamp at a net gain of 13 dB or so, which might help with the overload problem (and also raise the compression point above zero). I'll try to run these tests and report on them in a future "Above and Beyond" column.

SSB Electronics MV 220 GaAsFET Preamplifier, Price Class: $180; US Importer: The VHF Shop, 16 S. Mountain Blvd., Mountaintop PA 18707.

Peter H. Putman KT2B
Morris Plains NJ

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

PACKETEERING

I have seen the future and it is digital.

After several months of abject poverty, brought about primarily by the purchase of a home satellite TV system, I finally decided to take the plunge and invest in a packet radio terminal node controller (TNC). The result has been the most fun I've had in amateur radio since I gave the local repeater coordinator a hotfoot at the 1978 LIMARC hamfest and flea market.

Packet radio, fellow hams, is going to save our hobby. Don't let anyone else tell you anything different. I will be so bold as to predict that packet will become one of our primary operating modes by the end of this decade. It will certainly overtake CW in number of users and will be a rival to phone operation within a few years. Hams will still use CW for recreational purposes—just as some people occasionally like to ride a horse instead of drive an automobile—but packet is destined to become our primary method of transmitting text information. *Requiescat in pace* CW, RTTY, and AMTOR.

What makes packet communication so wonderful? Well, imagine being able to tie into international computer bulletin boards, to swap error-free messages and programs, and to have your computer send and receive data even when you're away or asleep. Who needs CompuServe, The Source, or those other high-priced on-line information services? Hams will do it better and for free. That is the heritage that has been handed down to us from the radio pioneers.

Packet, thankfully, is also relatively inexpensive. A $150 TNC connected to your existing 2-meter FM ricebox and home computer will put you in business. Heck, I've seen CW keyboards that cost more.

As you may have guessed, this month's questions are about packet radio. For those of you who aren't yet acquainted with the technology, I hope you'll read along. You may pick up some information along the way. As for packet veterans: the future is ours.

QUESTIONS

1) Packet radio sends data one character at a time.
   1) True
   2) False

2) A packet transmission *must* contain only ASCII characters.
   1) True
   2) False

3) A packet length is usually:
   1) 32 characters long
   2) 40 characters long
   3) 80 characters long
   4) 128 characters long

4) When were ASCII data transmissions made legal in the United States?
   1) January, 1970
   2) March, 1975
   3) March, 1980
   4) November, 1983

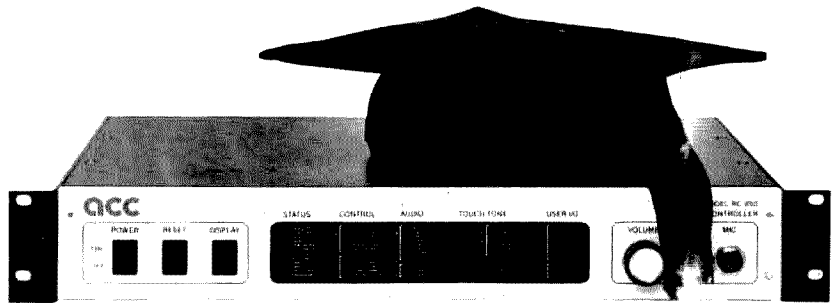
5) What is the maximum allowable baud rate below 28 MHz?
   1) 170 baud
   2) 300 baud
   3) 1,200 baud
   4) 2,400 baud

6) Above 220 MHz?
   1) 1,200 baud
   2) 2,400 baud
   3) 9,600 baud
   4) 56,000 baud

7) Approximately how many TNCs were sold during 1985?
   1) 100
   2) 1,000
   3) 10,000
   4) 100,000

8) Which of the following firms *does not* manufacture a TNC?
   1) Heath
   2) Kantronics
   3) AEA
   4) ICOM

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9) Most packet activity is on:
1) HF
2) VHF
3) UHF
4) satellites

10) A packet network is a type of:
1) local area network (LAN)
2) database
3) communications protocol
4) telephone packet switching network

11) A primary packet channel is:
1) 146.52 MHz
2) 144.11 MHz
3) 145.01 MHz
4) 21.390 MHz

12) A digipeater is:
1) a dual frequency data repeater
2) a single frequency data repeater
3) illegal below 28 MHz
4) very expensive

13) A packet beacon runs continuously.
1) True
2) False

14) Which of the following *is not* a packet protocol?
1) AF2M
2) AX.25
3) VADCG

15) What city had the first U.S. digipeater?
1) New York
2) San Francisco
3) Boston
4) Los Angeles

16) A common serial interface is:
1) a Centronics port
2) an RX-7
3) hard to find
4) an RS-232C

17) AMSAT is planning to launch a packet radio satellite. It will be called:
1) OSCAR 17
2) PACSAT
3) DIGISAT
4) PACSTAR

18) TERRACON is:
1) another planned packet satellite
2) a ground-based packet linking system
3) a packet-based emergency warning system
4) packet for MARS operators

19) What *is not* useful in a packet beacon transmission?
1) Brevity
2) Name of operator
3) QTH or grid locator
4) graphics

20) Packet is allowed on Novice frequencies.
1) True
2) False

21) SKIPCON is:
1) an HF packet linking system
2) limited to speeds under 100 baud
3) an AMRAD project
4) all of the above

22) The TNC uses a bit-oriented standard known as:
1) an HDLC
2) an HLPT
3) a VADCG
4) an RS-232C

23) 1,200 baud is roughly equivalent to how many CW words-per-minute?
1) 60 wpm
2) 120 wpm
3) 500 wpm
4) 1,500 wpm

24) A TNC is roughly equivalent to what other type of computer peripheral?
1) modem
2) file server
3) terminal
4) printer

25) Packet is not allowed on 6 meters.
1) True
2) False



WHERE IS IT?

This is where the *73* staff would like to go after a hard day's work, or even an easy day's work, but we can't find it! We will give the first person to help us a year's subsription—or subscription extension—to *73*. *Mail* us, *in an envelope*, the full address and *identify the next-door sandwich shop!* Address: *73* Magazine Bar Contest, WGE Center, 70 Rte. 202N, Peterborough NH 03458. Earliest postmark will be the winner. Photo by Tedd Cluff.

THE ANSWERS

1—2 Data is contained in "packets" or bundles of data. A very frequency-efficient way to send information, since the transmitter is keyed on only when data is sent. And data is always sent at the fastest possible rate.
2—2 A packet may also contain such non-ASCII codes as Baudot or EBCDIC.
3—4 Helps to keep users from hogging a channel.
4—3 After years of lobbying by hams.
5—2 Band conditions and frequency constraints are the limiting factor.
6—4 Pretty fast.
7—3 Not a bad start.
8—4 But I bet you they eventually will.
9—2 Two meters, primarily.
10—1 Just a fancy name for a bunch of packet users.
11—3 Particularly on the east coast.
12—2 Almost any packet station can act as a digipeater.
13—2 It should come on every 10 or 15 minutes, at most.
14—1 AF2M is an Extra-class ham.
15—2 Ah. The old Silicon Valley crowd wins again.
16—4 The serial interface found on most personal computers.
17—2 A logical name.
18—2 TERRACON may one day link together all North American packet users through microwave relays.
19—4 Sort of a time and frequency waster.
20—1 But not by Novices, unfortunately.
21—4 HF may be unpredictable, but still useful.
22—1 High-Level Data Line Control.
23—4 Shows you how s-l-o-w CW is.
24—1 A very smart modem.
25—2 Although your neighbors may wish so.

SPECIAL EVENTS

COLUMBUS IN
APR 5

The Third Annual Columbus Amateur Radio Club Swapfest will be held Saturday, April 5, from 9 am to 5 pm at the Columbus IN 4-H Fairgrounds on SR 11 South. Talk-in on 146.790 repeater. For advance reservations write Chuck Roberts WD9DWI, 2950 S. Lake Drive, Columbus IN 47203.

ROCHESTER MN
APR 5

The Ninth Annual Rochester Area Hamfest will be on Saturday, April 5, starting at 8:30 am (setups on Friday from 4:30–6:30 pm). Sponsored by the Rochester Amateur Radio Club, Inc., raffle and drawings prizes include: Kenwood TR-2600 synthesized HT, Bearcat 20/20 programmable scanner, and a Ham IV rotor. Tables will be $8 each. In lieu of cash payment for tables you may donate prizes of at least equivalent value. In this case, prize certificates received will serve as advanced payment and reservation confirmation. For more information, write W.C. McGurk WBØYEE, 2253 Nordic Ct. N.W., Rochester MN 55901, or call (507)-288-7688.

MADISON WI
APR 6

The Madison Area Repeater Association will hold its 14th annual Madison Swapfest on Sunday, April 6, at the Dane County Exposition Center Forum Building in Madison WI. Doors will open at 7:30 am for flea-market sellers and at 8 am for the public. Admission is $2.50 in advance and $3 at the door. Flea-market tables are $5 in advance and $6 at the door. Talk-in will be on the M.A.R.A. repeater, WB9AER/R, 146.16/.76. For more information, write: M.A.R.A., PO Box 3403, Madison WI 53704, or call (608)-222-4744, day or night.

OLD BRIDGE NJ
APR 6

The Old Bridge Amateur Radio Association will hold an indoor/outdoor Electronics Flea Market, April 6, at the Knights of Columbus Hall in Old Bridge. The hall is located on Pine Street off Rt. 18 in Old Bridge. Talk-in frequencies are 147.120+600 and 146.520. Admission will be charged and a door prize will be awarded. Sellers may register by mail. Send SASE for details to Bob Navin, 106 Madison Ave., Old Bridge NJ 08857.

CLARKSVILLE TN
APR 6

The Clarksville Amateur Transmitting Society is sponsoring a swapfest on Sunday, April 6, starting at 9 am, at the National Guard Armory on Highway 41A in northern Clarksville. Amateur license tests will be given. Admission is free. Tables are $5.00 (single) and $7.50 (double). Talk in on 146.205/.805 or 147.43. For reservations or information, contact CATS, 1550 Armistead Drive, Clarksville TN 37042; (615)-648-3657.

TIMONIUM MD
APR 6

The Baltimore Amateur Radio Club will present the 1986 Greater Baltimore Hamboree and Computerfest on April 6 at the Maryland State Fairgrounds Exposition Complex at Timonium MD. Gates open at 8 am. The fairgrounds are located east of I-83 exit 17, three miles north of I-695, just north of Baltimore. Admission is $4, children under 12 free. For further information, contact: G B H & C, PO Box 95, Timonium MD 21093-0095, or call (301)-561-1282. For a recorded announcement, dial: (301)-HAM-TALK.

GROSSE POINTE MI
APR 6

The South Eastern Michigan Amateur Radio Association (SEMARA) will hold its 28th annual Hamfest Swap and Shop at the Grosse Pointe North High School, 707 Vernier Road, Grosse Pointe Woods MI, from 8:00 am to 3:00 pm. The Hamfest will feature an ARRL forum, DX forum, and a RTTY forum. Advance tickets $1.00, at the door, $3.00. Advance tables $8.00, at the door, $10.00. Talk-in on 147.75/.15 and 146.52. For more information, write to SEMARA Hamfest, PO Box 646, St. Clair Shores MI 48080, or phone Fred Lewis NK8M at (313)-881-0187.

KANSAS CITY MO
APR 11–13

The PHD Amateur Radio Association, Inc., will sponsor the annual Missouri State ARRL Convention April 11–13. Location is the old Kansas City MO airport, just north of downtown Kansas City MO. There will be commercial exhibits and 300 swap tables, all indoors. The banquet will be held Saturday night. Registration is $4 (good all 3 days), and swap tables are $10 (includes one registration). Banquet and swap tables should be requested in advance. Talk-in on 34/94 repeater. Registration and other information is available from the PHD Amateur Radio Association, PO Box 11, Liberty MO 64068-0011, or call (816)-781-7313 or (816)-452-9321.

SAGINAW MI
APR 11–12

The Saginaw Valley Amateur Radio Association, Inc., (SVARA) is hosting a State Convention for ham radio operators and computer buffs at the Saginaw Civic Center, April 11 and 12. NASA astronaut Tony England will be the featured speaker. For further information, write or call SVARA, PO Box 6662, Saginaw MI 48608, (517)-752-9740 or 776-1470.

BERWICK BICENTENNIAL
APR 12

The Columbia-Montour ARC will sponsor Special Event Station KC3TX commemorating the bicentennial of the city of Berwick PA. Operation will be in the General-phone portion of the 20- and 40-meter bands from 1700Z to 2400Z on April 12.Send QSL and $1 for a nice certificate to CMARC, PO Box 930, Berwick PA 18603.

GREENCASTLE IN
APR 12

The Putnam County Amateur Radio Club will hold its fourth annual Hamfest and Auction April 12, at the Putnam County Fairgrounds, north of Greencastle IN on US 231. Admission is $3 per person; children under 12 are free. Doors open for setup at 6:30 am, and open to the public at 8 am The auction is at 1 pm. Flea market space: our tables $3 each; your tables $2 each. Commercial exhibits welcome. Talk in 147.33/.93. For more information or table reservations send a SASE to Kent Douglas K9JCR, RR#4 Box 586, Greencastle IN 46135; (317)-672-8237, or Nick Aubrey N9FCB, RR#2 Box 592, Greencastle IN 46135; (317)-653-5290.

LAWTON OK
APR 12

Lawton Fort Sill Amateur Radio Club's annual event will be held April 12 at the County Fairgrounds, 8 am to 6 pm. This year the theme is "An Old-fashioned Swapfest." Registration fee is $2; table fee is $5; tailgate fee is $3. No pre-registration necessary except for table space. For more information, write Don Hagler, 912 Bell, Lawton OK 73505.

FRAMINGHAM MA
APR 13

The Framingham Amateur Radio Association will hold its annual Spring Flea Market and exams on Sunday, April 13, at the Framingham Civic League Building, 214 Concord St. (Rt. 126), downtown Framingham. Doors open at 10 am (sellers may begin setup at 8:30). Admission is $2, and tables are $10 (includes one free admission). Pre-registration is required for tables and exams. Talk-in on .75/.15 repeater. To reserve tables, write Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701, or call (617)-877-7166. To register for license exams, send completed form 610, copy of ham license, and a check for $4 (payable to ARRL/VEC) to FARA, PO Box 3005, Framingham MA 01701. Walk-in exams given on a space available basis.

BEDFORD PA
APR 13

The annual Southern Alleghenies Hamfest '86 will be held from 7 am to 4 pm on Sunday, April 13 at the Bedford County Fair Grounds in Bedford PA. (Pennsylvania Turnpike, Exit 11). Admission is $3. Plenty of tailgate space is available. Inside table spaces reserved at your request. A consignment auction will be held. Sponsored by the following clubs: Horseshoe Radio Club, Blue Knob Repeater Association, Bedford Co. ARC, Mountain ARC, and Somerset Co. ARC. Talk-in on 145.49/.89, 144.42/.92, and 146.52 simplex. For more infor-

mation, contact Gay Rembold W3DFW, 949 Winifred Road, Cumberland MD 21502, or call (301)-724-0674 or (814)-445-7486.

MOORELAND OK
APR 13

The Great Plains ARC fifth annual Northwest Oklahoma Eyeball & Swapmeet will be held in Mooreland OK on Sunday, April 13, starting at 9 am; $2 admission at the door. Covered-dish dinner at noon. Local airport. Dealer and swap tables available at no charge. Talk-in on 147.72/.12, 146.13/.73 and 146.52 simplex. VE test given on Saturday, April 12. Campsites available. Directions: North on Main or Elm streets, across the tracks and west. For further information, call (405)-994-5394 or contact Gordon Richmond NR5L, Rt. 1, Box 12, Mooreland OK 73852, (405)-994-5453; or Gerald Bowman N5CCV, Box 356, Mooreland OK 73852.

TASTE OF ATLANTA
APR 18–20

The Metro Atlanta (GA) Telephone Pioneers Amateur Radio Club (MATPARC) will operate special station W4OTA during the Taste of Atlanta food festival April 18–20. Operation on Friday and Saturday will be from 1500Z to 0300Z, and the station will be on Sunday from 1700Z to 2300Z. Frequencies are 7.285, 14.285, 7.055, 14.055, 144.81/.41, and 449.150/444.150 MHz. A special QSL is available for an SASE sent to MATPARC/Taste of Atlanta, John C. Parker, PO Box 54017, Atlanta GA 30308.

SOUTH SIOUX CITY IA
APR 18–19

The Midwest Convention of the ARRL will be held at the Marina Inn in South Sioux City IA on April 18 and 19, under the sponsorship of the 3900 Club. The convention will feature forums and an indoor flea market, and commercial exhibitors will be on hand to answer questions on the latest equipment. Bring your 2-meter rig for a free "tune-up," courtesy of Burghardt Amateur Center. Volunteer exams will be given on Friday the 18th. Pre-registration information should be directed to Dick Pitner WØFZO, 2931 Pierce, Sioux City IA 51104. Flea market reservations should be sent to Glenn Holder KØTFT, RR#1, Hinton IA 51024. Further information can be obtained through Convention Chairman Al Smith WØPEX, 3529 Douglas St., Sioux City IA 51104.

GROTON CT
APR 19–20

The Radio Amateur Society of Norwich (RASON) will operate Croaker Memorial Special Event Station KA1IFG from 1700Z April 19 to 1700Z April 20 from aboard the submarine *USS Croaker* to commemorate the 42nd anniversary of its commissioning. Look for us on these frequencies: SSB—3.890, 21.290; CW—3.730, 7.130, 21.130. QSL with SASE to RASON, PO Box 903, Norwich CT 06360.

HAM AND YAM FESTIVAL
APR 19–20

The Johnston Amateur Radio Society will help celebrate the second annual Smithfield (NC) Ham and Yam festival with special event station KA4HAM. Operation is from 1400Z to 2400Z both days on 3.855, 7.230, 14.255, 3.708, and 7.110 MHz. For a special QSL and certificate send a large SASE to Mark Gibson N4MQU, PO Box 2084, Smithfield NC 27577.

SULLIVAN IL
APR 20

The Moultrie Amateur Radio Klub (MARK) hamfest, formerly held at Sullivan IL, will be held Sunday, April 20, from 8 am to 3 pm at the Coles County Airport, located between Mattoon and Charles IL on Rt. 16. The hamfest will be in a large, heated hangar. Admission is $2 advance, $3 at door. No extra charge for vendors, but bring tables. Talk-in on 146.655/146.055 or 146.52. Further information, write MARK, PO Box 79, Sullivan IL 61951, or call Vernon Jack K9SWY at (217)-728-7596.

CAMBRIDGE MA
APR 20

The MIT Electronics Research Society and UHF Repeater Association will hold its tailgate high-tech, computer, and amateur radio Flea Market on Sunday, April 20, from 10 am to 4 pm, at Albany and Main Street in Cambridge MA. Admission is $1.50. Free off-street parking for 500 buyers. Tailgate room for 200 sellers. In the event of rain, covered tailgate area will be available for all. Sellers: $5 per space (includes one admission). Setup 9 am. For space reservations or further info, contact Jamie at (617)-262-5090 or 253-2060. Talk-in on 146.52 and 449.2/.444.2 (W1XM/R).

BRAINTREE MA
APR 20

The South Shore Amateur Radio Club of Braintree MA will hold its annual indoor flea market on Sunday, April 20, at the Viking Club, 410 Quincy Ave., Braintree MA from 11 am to 4 pm. There will be tables available for $12 each, which includes one free admission if paid for in advance by sending the appropriate amount to Ed Doherty W1MPT, 236 Wildwood Ave., Braintree MA 02184. Tables will cost $18 on the day of the sale. Checks should be made payable to the South Shore Amateur Radio Club. Confirmation of check receipt will be sent; no cancellation refunds after April 16. The Viking Club will open to vendors only at 9:30 am. Entrance fee $2. Plenty of parking. Questions? Call (617)-843-4431, evenings.

DAYTON OH
APR 25

The Miami Valley FM Association will sponsor the 17th annual B*A*S*H, on Friday night of the Hamvention, April 25, at 7 pm in the Conference Center at the Hara Arena and Conference Center, Dayton, Ohio. There is no admission charge.

DAYTON OH
APR 25–27

The Dayton Amateur Radio Association, Inc., will sponsor the Dayton Hamvention on April 25–27, 1986, at the Hara Arena and Exhibition Center, Dayton OH. Admission, valid for all three days, is $8.00 in advance, $10.00 at the door. Banquet tickets: $14.00 in advance, $16.00 at the door *if available.* Ladies luncheon, $6.75. Advance sale deadlines: April 5 (Canada) and April 12 (USA). Roy Neal K6DUE will be the banquet speaker.

Giant Flea Market: noon Friday through Sunday. *All spaces sold out.*

Technical forums on: personal computer, packet radio, ARRL, AMSAT, antennas, RTTY, SSTV/ATV, FCC, electrical safety, and other topics. CW Awards—try to break the 72.5-wpm world record!

License exams: Novice through Extra, by reservation only. Send before March 29: completed form 610, a copy of your present license, and check or money order for $4.25 payable to ARRL/VEC, to: License Exam, Attn. Tom Holmes, 8830 Windbluff Pt., Dayton OH 45459.

Send nominations for "Radio Amateur of the Year," "Special Achievement," and/or "Technical Achievement" Awards, to Awards Chairman, Box 44, Dayton OH 45401, before April 1.

For further information, see HAMVENTION ad on page 23.

DAYTON OH
APR 25

The Dayton-Cincinnati chapter of the Quarter Century Wireless Association will hold its 1986 annual banquet on April 25, the Friday night of the Dayton Hamvention. Leland Smith, national QCWA president, will speak on "The Future of Amateur Radio." Happy hour is at 6:30; dinner is at 7:30 at the Imperial House, I-75 and Needmore Road. For tickets and information contact Bob Dingle KA4LAU, 657 Dell Ridge Drive, Dayton OH 45429. QCWA membership is not required to attend.

FITCHBURG MA
APR 26

The Montachusett Amateur Radio Association will hold Flea Market Saturday on April 26 at the Knights of Columbus Hall on Electric Avenue, Fitchburg MA. Doors open at 8 am for sellers and 9:30 am to 3 pm for buyers. Talk-in on 144.85/145.45 and 146.52. Admission is $1; tables $8 each. For table reservations send check payable to M.A.R.A., c/o James Beauregard, 7 Mountain Ave., Fitchburg MA 01420.

CEDARBURG WI
MAY 3

The Ozaukee Radio Club, Inc., will sponsor its 8th annual Cedarburg Swapfest on Saturday, May 3, from 8 am to 1 pm at the Circle B Recreation Center, Highway 60 and County I, in Cedarburg WI (20 miles north of Milwaukee). Admission is $2 in advance, $3 at the door. Four-foot tables are $3 each. Sellers will be admitted at 7 am for setup. For more information, send a business size SASE to 1986 ORC SWAPFEST, 101 E. Clay St., Saukville WI 53080.

ROGERS AR
MAY 3

The Northwest Arkansas Amateur Radio Club, Inc. will hold its Sixth Annual Hamfest on Saturday, May 3, at the Rogers Youth Center, 315 W. Olive St., Rogers AR from 8 am to 4 pm. Commercial exhibitors and flea-market tables, $2 per space, first come, first served (doors open at 6 am for exhibitors only). General admission free. Parking, eating establishments nearby; snack bar on premises. Talk-in on .16/.76, .63/.03 and .52 simplex. For more information, write Roy Milliren AF5W, 2014 S. 16th St., Rogers AR 72756.

STIRLING NJ
MAY 4

The TCRA Hamfest (Tri County Radio Association) will be held rain or shine on Sunday, May 4, from 9 am to 3 pm at the Passaic Valley Community Center off Valley Road, Stirling NJ. Free parking is available. Tables are $7, ac $10. Registration is $2. Limited tail-gating by reservation only please. All reservations through Dick Franklin W2EUF, Box 182, Westfield NJ 07090; (201)-232-5955.

MELVILLE LI NY
MAY 4

The Suffolk County Radio Club Indoor-Outdoor Electronic Flea Market will be held Sunday, May 4, from 8 am to 3 pm at Republic Lodge No. 1987, 585 Broadhollow Road (Route 110), Melville LI, NY. Plenty of free parking. General admission is $2 (wives and children under 12 admitted free). Indoor sellers tables are $7 and outdoor space is $5; each includes one admission. Talk-in on 144.61/145.21 and 146.52. For additional information, contact Bill Sullivan N2ETG, (516)-689-9871, evenings.

GRAND JUNCTION CO
MAY 10

The Grand Mesa Repeater Society will hold the Seventh Annual Western Slope Amateur Radio and Computer Swapfest on Saturday, May 10, 1986, from 9:00 am to 4:00 pm at the National Guard Armory, 482-28 Road, Grand Junction CO. Admission is free and swap tables are $5.00 each. Features will include an indoor swapfest, amateur radio exams, a packet radio demonstration, an auction, and refreshments. Talk-in on 146.82 and 449.20. To reserve a swap table and for further information, send an SASE to Larry S. Brooks WB0ECV, 3185 Bunting Ave., Grand Junction CO 81504, or call (303)-434-5603.

ROCHESTER NY
MAY 16–18

The Rochester Hamfest and Atlantic Division ARRL Convention, sponsored by the Rochester Amateur Radio Association, Inc., will be held May 16, 17, and 18 at the Monroe Country Fairgrounds, Rochester NY. Tickets are $5 in advance, $7 at the gate. There will be an outdoor flea market, $5 per space. Special indoor flea market for non-commercial exhibitors, upon application in advance only, $75. For tickets, write Hamfest Tickets, 174 Croydon Road, Rochester NY 14610. For more information, write Rochester Hamfest, 300 White Spruce Blvd., Rochester NY 14623, or phone the Hamfest BBS at (716)-424-7136. Talk-in on 146.28/.88. Please note: If you plan on staying at a motel within 40 miles of Rochester, reservations are a must!

RANDOLPH OH
MAY 18

The Portage Amateur Radio Club, Inc., will hold the 1986 Portage Hamfair for radio amateurs and computer hobbyists on Sunday, May 18. It is open for dealers beginning at 6 am and for the public at 7:30 am at the Randolph Fairgrounds, Randolph OH. This fairgrounds facility will accommodate indoor dealer sales as well as an outdoor flea market. Indoor/outdoor spaces can be purchased for either $2 for each 10-foot linear space (no table or chair) or $6 with 8-foot table and chair. Advance reservation recommended; otherwise tables will be available at the door on a first-come-first-served basis. Admission is $3 in advance, $3.50 at the gate. Talk-in on 144.79/145.39. For info or tickets, write Robert Ducotey KX8V, 9971 Diagonal Road, Mantau OH 44255 or call Garry Delagach KD8JM at (216)-274-8240.

KNOXVILLE IL
MAY 18

The Knox County Amateur Radio Club, Inc., 4th Annual Hamfest will be held on May 18, at the Knox County fairgrounds (exit 51 off Interstate 74). Camping area available. Flea market. Large commercial vendor building. Gate opens at 7 am, Commercial Building at 9 am. Donations $4 at gate or $3 in advance to Stuart Schrodt, RR2, LS 19, Avon IL 61415; (309)-465-3107.

DURHAM NC
MAY 24

The Durham FM Association will hold its annual Hamfest and Computerfest on Saturday, May 24, at the lower level of South Square Mall in Durham NC from 8 am to 4 pm. The flea market will be held under a covered parking deck. Talk-in will be on 147.825/.225. Free parking, numerous prizes, and tables will be available. FCC exams are planned. Admission will be $4 at gate. For further information, contact D.F.M.A., PO Box 8651, Durham NC 27707, or call Mick W4ZUS at (919)-544-3556.

TRACY QUE
MAY 25

The Quebec Provincial Hamfest will be held Sunday, May 25, beginning at 9 am (8 am for exhibitors) at the Tracy Curling Club, Place du Centre Civic, Tracy, Quebec Province, Canada. Indoor tables are $8 (includes one admission); outdoor tables are $6—reserve all tables before May 20. Admission is $4. Talk-in, VE2RBS 146.610/.010. Write C.R.A. Sorel-Tracy, C.P. 533, Sorel, Quebec, Canada J3P 5N6.

BEAVERTON OR
JUN 6–8

The 6th annual SEA-PAC Convention (formerly Oregon State) will be held from 5 pm Friday, June 6, to about 2 pm, Sunday, June 8 (open for setups at 10 am Friday), at the Seaside Convention Center, Seaside, OR. Booth space is 8 ft. x 10 ft. with table, chairs, power, and so on for $120; 24-hour security is provided. For motel information, call (800)-452-6740 (from Oregon only) or (503)-738-6391; for other information, write OTVARC, PO Box 5132, Beaverton OR 97006 or call, evenings only, (503)-640-5456 or (503)-297-1175.

WILLOW SPRINGS IL
JUN 8

The Six Meter Club of Chicago, Inc., announces its 29th annual Hamfest, to be held Sunday, June 8, 1986, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL (southwest of downtown Chicago). Reservations for space in the pavillion will be accepted on a first come, first served basis. A donation of $20 in cash per table space is requested. For details, write John Trepina K9QYT, 5015 W. 31st Place, Cicero IL 60650.

RAILROAD DAYS
JUN 21–22

The Great Plains ARC will hold a special-event station June 21 and 22 in conjunction with Railroad Days in Oelwein IA. The bands used will be 20m at 14.235 ± QRM, 40m at 7.235 ± QRM, and 80m at 3.970 ± QRM. The call used will be KC0CP. For certificate, send SASE and QSL to KC0CP, Box 203, Oelwein IA 50662.

GERMANTOWN MD
JUL 27

In celebration of the 40th anniversary of Montgomery College, Montgomery County MD, the Germantown Campus Amateur Radio Club will operate KV3S on Sunday, July 27, 1986, from 1300Z to 2000Z. Frequencies: 7.240 and 14.240 (approximate). A certificate will be awarded to all. Special certificates will be awarded to those whose birth year is 1946 and to those who work KV3S on the 40-meter band. For certificate, send QSL and large SASE to KV3S, Montgomery College, Germantown MD 20874.

ESCANABA MI
AUG 2

The 38th annual Upper Peninsula Hamfest, sponsored by the Delta County Amateur Radio Society (DCARS), will be held August 2, at Bay de Noc Community College in Escanaba MI. This is an ARRL-sanctioned Hamfest and the only one to take place in the upper peninsula of Michigan. Registration will be $2. Donations from organizations to be used for door prizes and awards would be greatly appreciated. All donations will be displayed with the donor's name prominently shown. Donations should be sent to Hamfest Co-chairman Tom Elegeert K8MJK, 1403 S. 13th St., Escanaba MI 49829. For further information, contact Co-chairman Aileen Gagnon WA8DHB, 9159 Bay Shore Drive, Gladstone MI 49837.

NEVER SAY DIE

from page 11

Some just make a noise—others call the police by telephone, others use radio.

Now if you really want to get into it in a very big way, how about putting together some alarm kits and selling them by mail order? I saw plenty of car alarms at the Consumer Electronic Show in Las Vegas in January, but little in home alarm kits. If I wasn't busy with a lot of other things I'd do it myself. Just what I need—one more business. I'd tell you about all the businesses I'm in now, but you wouldn't believe me.

One of my areas of expertise is in making lots of money. I not only have done it, I also give talks on the subject. There are a million millionaires in the United States, so it's no big deal anymore. Almost anyone who really wants to can make a million. I counted ten hams who stopped me at CES to thank me for goading them in my *73* editorials into starting their own businesses and getting rich.

I don't know if you've noticed 8mm video yet. Well, I bought a Sony 8mm camera and VCR and I want to tell you that from what I can see 8mm is going to quickly wipe out Beta and then, eventually VHS. We're going to be seeing low-cost, high-quality video cameras all over the place. Mark my words, you're going to see 8mm video used by virtually every business and in most homes. If you want to get in on the next consumer electronic explosion, see what you can do making some 8mm video accessories or opening 8mm video stores. 8mm video is darned close to ¾-inch video in quality—and a lot better than the ½-inch Beta and VHS formats. The cameras are small and light. The 8mm tape cassettes are about the size of an audio cassette.

For a while the computer business was an easy way to make money. That's slowed down now, but there are other industries coming along. Let me know if you want me to write more about the opportunities. I'll have to swear you to secrecy—we don't want any non-hams getting in on a good thing, do we?

READER'S SERVICE CARDS

I don't know why the previous publisher of *73* dropped the reader service cards—but they're back. The cards are there for you to use to get more information on products you're interested in buying. Buying ham gear is a lot of fun. I don't know of much more exciting than opening up a ham rig carton and setting up a new rig.

Please remember that it's the advertisers who make *73* possible—so treat them kindly. They get all excited when they think you're interested in their products, so give them a shot of adrenaline by circling their number on the card. From there on it's up to how good they are at sending you a sales pitch on their product. If they do a good solid job of selling, who can resist? If they don't send you literature that is almost impossible to resist, send it on to me with your comments. Maybe they need some help.

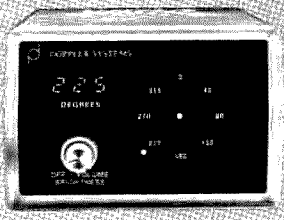
Whatever you do, don't be casual about the reader's service card. Tear it out and use it.

Yes, I know all about how much you hate cards bound into magazines. I hate 'em even more than you do. I read maybe 300 magazines a month, so my bedroom floor is ankle deep in blow-in and bind-in cards I rip out so I can turn the pages. Let me know if you are interested in starting a collection. So why all the cards in magazines? Because the foolish things work, that's why. Why did you think?

I fought the idea for a long time. Then I reluctantly tested it and found how well they worked compared to a coupon printed on a page. No comparison. So I grit my teeth and do what works, whether I personally like it or not. Permission is granted for you to hate the cards—rip 'em out—but then fill 'em in and mail 'em to me—with reader's service and subscriptions.

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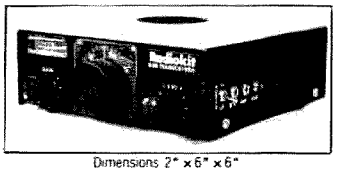


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THEY LAUGHED WHEN I SAT DOWN TO BUILD . . .

How would you like to get involved with building some interesting ham projects? Even if you've never pointed to a soldering iron in anger—good grief, there I go dating myself again. Soldering iron, forsooth! Okay, okay, soldering pencil.

While it isn't prudent to tackle building your own synthesized sideband transceiver these days, it's about the only way you're going to get many small gadgets that will be fun to have around your shack. And I have a sneaky plan to bribe you to design and build simple projects.

If you tune around 75m some evenings and listen to the old-timer round-table discussion grousing about how hams don't build anymore, you may tend to believe these fogies. Balderdash! As I've mentioned before, in the early days of ham radio every ham had to build his own receiver and transmitter. Then, when Hallicrafters came out with their first ham receiver (was it the S-1 Skyrider?) hams immediately stopped building receivers.

We all built our own transmitters until well after WWII. It wasn't until then that we had enough hams to make the commercial building of ham transmitters profitable. Amateur radio really got going after 1945, growing a steady 11 percent a year for 17 years—a nice market for commercially made ham rigs.

The few hams who built their own transmitters discovered that this was stupid. The cost of the parts ate them up—and then, when they wanted a new rig they found no sale at any price for a used home-made rig.

One of the reasons I started *73* magazine in 1960 was to publish as many simple construction projects as I could to encourage hams to keep building. I published mountains of articles on building ham gadgets, test equipment, antennas, audio stuff, electronic toys and so on. It worked.

73 was the pioneer in getting hams to build VHF and UHF gear—in getting hams to build solid-state equipment—and then digital, even getting the readers into computers.

No matter how much commercial ham gear we have available, there is still an almost unlimited number of interesting things that we can have only if we build them. Now, 25 years later, *73* is again going to get ham building going in a big way. As I said, I have a sneaky plan.

KIT SUPPLIER WANTED

First, I'm looking for a "Chosen Instrument" company, one that will work with me to make parts kits available for the articles published in *73*.

I'm sure it has not entirely escaped your notice that parts are darned hard to find these days. It's enough to discourage most of us after one or two attempts. It's not like it is in Japan where there is a whole section of Tokyo that specializes in selling electronics parts. There are hundreds of small parts stores—all swarming with thousands of happy Japanese youngsters buying parts. The best we seem to have these days is the slim selection of overpriced parts from Radio Shack stores.

It isn't that there are no parts being made; it's just that you have to buy them in bulk these days—as a manufacturer. The 1963 Incentive Licensing disaster not only put 90 percent of the ham stores in America out of business, it also killed the distribution of electronic parts.

In 1964 I tried to solve this problem by setting up a Parts Kit division of *73*. I bought a huge metal knife to cut out the chassis and panels, a metal brake to bend them, a metal punch set to make the needed large holes and a drill press for the small holes. I bought parts by the zillions from Evans Radio in Concord NH, and sold thousands of boxes of parts for the *73* construction projects.

The parts kits business went well. Oh, a few ham dealers got mad at me for "taking business away from them." But it did encourage thousands of readers to build. The bad aspect was that it kept me incredibly busy. In addition to the kits, I was running a small printing press putting out a monthly VHF magazine, a club newsletter, and an ATV magazine. Then, when my divorce hit, I lost my steam and had to cut back—which included stopping the kits and the small magazines. I even had to get someone else to run *73* for a couple of years.

There's a nice living to be made in the kit business—not a big one, unless we get a spurt of new hams. If some firm is interested, *73* will work with it to coordinate kits and articles.

A ROYALTY TO YOU

Having parts kits is a waste of time unless we have articles on projects you want to build. What I have in mind here is some good old-fashioned bribery. Greed usually works just fine as a motivator. So here it is . . . if you make a gadget that you think *73* readers may be interested in duplicating, write it up, take some pictures, and submit an article. If we accept it, we'll pay you for the article upon acceptance—something some other ham magazines I could name don't do. Secondly, we'll work with the kit people to have a kit made up to support your project. You may want to work with the kit people to simplify or standardize parts. For instance, it isn't very helpful to specify some part you can pick up only at the Dayton flea market. Then, we'll see that the kit company charges enough for the kit so there's a 10 percent royalty in it for you.

Let's say you make up an RTTY demodulator that sells in kit form for $150. You get a $15 royalty on each sale. So, if only a thousand readers buy the kit, you'll get $15,000 bonus for your efforts. Heck, that could be a trip to Europe for you and the XYL, plus maybe a fur coat. You can do a great Asian tour for $6000 for the two of you. But then, you probably won't need expert advice on how to spend the rising tide of money your building efforts can provide. If you find yourself desperate for spending advice, I'll put you in touch with my XYL, a world-class expert.

I'll bet you have something in mind to build right now.

***HR* NOMINATED FOR PRIZE**

HR magazine set a new record in my mind when they reported in their February issue that I was back running *73* magazine. They quoted correctly that I view amateur radio as a dying hobby—and quoted *in*correctly that I've ever said I no longer had any serious interest in it. You won't find anyone anywhere who's ever heard me say that—even on a bad day.

So, with *HR* reaching a new high—only 50 percent wrong—I think they should be given positive encouragement to shake their old "Half Right" nickname. Alas, it seems to have been an impossible goal for them so far, but who knows?

MIAMI HAMBOREE '86

With our hobby coming apart at the seams, how are institutions such as the Hamvention and the Miami Hamboree doing? Even though I wasn't invited to come, I decided to check the Hamboree out.

The Hamboree committee really went out of their way to make things convenient for exhibitors—coffee and doughnuts in the morning and nice lunches delivered to the booths. Dayton, take note!

It's a bit of a shock to get on the plane in Boston with the February temperature well below freezing and emerge in Miami with temperatures in the 80s. I flew down on beleagured Eastern Airlines, using my "Get Up and Go" senior citizen's pass.

The pilot enthusiastically explained all about the brand new Boeing plane he was so proud to be flying—one of the reasons, as I recall, why Eastern is in so much financial trouble. The new plane looked like a worn out junker to me. My tray table was already broken on one side. The toilet light didn't work. The lock on a storage cabinet in the toilet wouldn't close, so the door disconcertingly kept swinging open. This is a new plane? What'll it be like in a few months? It was workmanship like this that drove so many car buyers to foreign cars. Shape up, Boeing.

The Hamboree was in a new location this year—the Tamiami Fairgrounds. I think they've found a good spot. Well, a pretty good spot. There was no air conditioning, so even with a bunch of huge fans blowing, it got pretty hot, badly overloading current underarm deodorant technology.

As an exhibitor I was pleased with the number of attendees. With the help of *73* staffers Nancy Ciampa and Hope Currier, the *73* booth easily kept up with the traffic. I haven't seen the official counts, but I'd estimate they had at least two thousand hams and their families milling around. It never was really crowded, but there were few times when no one was in sight either.

As a show-goer I enjoyed having a chance to see and push buttons on the latest in ham technology. There were two huge flea-market halls, so even if it had rained, I still could have browsed dryly. It poured the day before the hamfest, so the potential was there, making the indoor sales area important.

I was a bit disappointed to see a few non-ham exhibits: Mary Kay cosmetics had a booth. And East-

ern Airlines. Boo. Eastern, I still remember that you were one of the first airlines to ban laptop computers, without any evidence they were a problem. My editorial in *Microcomputing* magazine forced them to rescind that ban.

The best part for me was the stream of hams stopping by the *73* booth to congratulate me on taking over the magazine again. If there were any Wayne Green haters at the Hamboree, they never came near the booth. I was surprised at the number of no-code enthusiasts who admitted they'd been opposed to the no-code license idea until they better understood what really was at stake. They said they now regretted having written the FCC with their first emotional reaction.

I suspect it's too late now as far as no-code is concerned, but I'll spend some time one of these months explaining the whole situation in depth so you can, in turn, explain it to your more volatile, but possibly not very thoughtful, friends. I tend to forget now and then after 35 years of being a ham editor and publisher that I have a different perspective on ham history than hams who are either new or who haven't paid a lot of attention down through the years.

You see, I not only know all the players today, I've known them, both good and bad, ever since I started editing ham magazines—and this August will be my 35th anniversary of that. Yep, in 1951 I'd just gotten a job as a TV director at WXEL in Cleveland, Ohio. I'd been deeply involved with ham Teletype for a couple of years and was frustrated that no one was publishing a RTTY newsletter. Lo, there was a mimeo machine! A few days later the first issue of a RTTY newsletter was born—and my publishing career inadvertently started.

One of the advantages, or disadvantages, of knowing everyone in the ham industry personally, which is what happens when you're a magazine editor, is that you know what is really going on as opposed to what most hams *think* is going on—the facade presented in *QST*.

NEW DEVELOPMENTS

There are a lot of new developments in amateur radio that I've got to get you interested in—like packet radio, repeater cross-banding, and so on. Many of you may be trapped in the past, spending your declining years talking with the same crowd every night. I'm going to try and get you to try something new and exciting.

The one topic that came up the most at Miami was the need for youngsters in the hobby. I've been griping about that for how many years now? As usual, sigh, I guess I was ahead of my time. The ham manufacturers had a meeting and that was number one, two, and three on their agenda.

Sure, I can just hear the senile old farts bitching now—the manufacturers want more hams so they can make more money. You bet they do! But that isn't all. Few hams are in the ham business today just to make money—there are far too many ways to make money easier—a whole lot easier. Most of them are in the business because they love hamming. I wish I could say *all*, but I did see a couple well-known slime-ball crooks exhibiting at the Hamboree, crooks who've cheated hams for years and are still at it. I hear Dayton isn't going to let these bastards exhibit this year. I sure hope not. I've been terribly dismayed to see their ads in one of the ham magazines. I guarantee you won't see 'em in *73*.

Speaking of rip-offs, I just got word that an old-time rip-off artist died. Nice old chap made a living selling high-powered CB amplifiers and expensive mini-antennas that didn't work worth a hoot. I refused to carry his ads, but one of the other ham magazines helped hundreds—maybe thousands—of hams get fleeced.

Some of the biggest crooks in the hobby used to run their ads in *QST*—did for years—despite zillions of complaints. I can remember two who were convicted, one with with my help. I doubt if that can happen today. I don't think Dave Sumner would let it.

Getting back to kids. I've got some ideas on ways for us to get our hobby growing again. My goal is simple: one percent of our population should be hams. Yep, I'm looking for us to get to two and a half million hams. Heh, and you thought 20 meters was crowded right now! Well, don't jump to conclusions. The fact is, I believe we won't find our bands much more crowded than they are today. We'll have enough clout to have more bands and we'll have the enthusiastic youngsters we need to pioneer new modes and new bands.

You know, not one cry of alarm I've been hearing for years about the invasions of CBers has ever been anything more than emotional baloney from our lunatic fringe Chicken Littles. Every time we have a really serious bad apple in our hobby, it's turned out to be an old-time ham with an IQ in the home-temperature-comfort range.

Speaking of CB, it's perhaps with some perversity that I rub old timer noses in the fact that the worst CB bad language and jamming cases in history had Extra Class hams licenses.

CB didn't do much good for us, really. Oh, we got a few hams out of it, but most CBers never got much interested in hamming—and if they did, they found it much easier to move higher in the 27 MHz band than to try and learn the code. The sun-spot cycle, not the FCC, gradually killed this bunch off.

Continued on page 98

WIN $500!

How long have you been a ham? Okay, in all that time, how many really funny ham stories have you read? I've been publishing ham magazines for 35 years and there are precious few I can remember in all that time.

Larson E. Rapp use to get some chuckles a generation ago in *QST*. Say, who wrote those pieces? I think I heard one time, but I've forgotten. Scratchi did pretty well in *CQ* when I was editing it, also a generation ago. I've forgotten who did Scratchi now, too, but I'll bet some reader knows—same W2 who edited the *GE Ham News* around 1947—look through your collection and let me know.

I didn't realize what a closely guarded secret Scratchi's name was until I'd invited the *GE Ham News* editor over to talk to the club. During dinner before the meeting he mentioned that he'd just made a deal with *CQ* to start writing the Scratchi column again. It's one which had previously appeared in *Radio* magazine, which faded away when WWII started. *Radio* was a wonderful magazine—beat the heck out of *QST* in every way. The ARRL never really got over the death of it's founder, Hiram Percy Maxim—also known as The Old Man (TOM). When he suddenly died around 1936 there was a fight for power which I hope will someday be documented. Maxim wrote several wonderfully humorous books—his "A Genius in the Family" was a best seller in the 30s.

Getting back to ham humor, long, long ago in *73* I had a wonderful piece by Jean Shepherd K2ORS. Jeans' promised to do more, but hasn't gotten around to it yet. I hope you've seen his movies on PBS—vintage Shepherd and very nicely done. Sherry's taped Jean's Christmas movie from one of the cable channels. I hope Jean'll do some more work for us to add to ham humor posterity before he becomes a silent key.

The best humor I've seen in any ham magazine was by Bob Manning K1LSD. I'll start reprinting some of his *73* stories from twenty years ago so you can see what I mean.

Another ham with a great sense of humor, but who rarely let it go in print, was Sam Harris W1FZJ. He did a piece for me in *CQ* which is still a classic on his Contest 100 Watt Final. When things get dull I pull that off the shelf and read it to visiting hams.

What I'm leading up to is this. With the exception of Shep, none of these hams were professional writers or humorists. I'm sure there are dozens of you who, if you gave it a try, could entertain us. Here's where the $500 prize comes in. I'm offering $500 for the best ham humor story submitted during 1986—as voted by the *73* readers.

Let's see what you can do. You couldn't ask for better source material than ham radio for humor. Please double space your manuscript. You get extra points if you do it on a word processor—there are even some people still writing longhand, despite the popularity and speed of the typewriter. A word processor makes writing even faster and much easier.

Please send your piece to Ham Humor, *73* Magazine, WGE Center, Peterborough NH 03458 USA. The sooner the better.—W2NSD/1.

NEVER SAY DIE

from page 94

A PUBLISHER'S WORK IS NEVER DONE

One thing—please do everything you can not to get upset if I don't answer you personally. I doubt if you know anyone who is as busy as me, so let's keep it with me writing editorials, you writing letters—and yes, I *do* read 'em. If you either are clever enough to make me laugh, or are so wound up about something as to actually be serious, there's a chance your letter, or at least embarrassing parts of it, may get published.

I'm not exaggerating about being busy. In addition to getting to hamfests, I also get to computer and consumer electronic shows—including a round of 'em in Asia in October. I also get out for some skiing in the winter and scuba diving in the summer, Honduras last August.

I'm also doing my best, which isn't all that good at times, to run a few businesses—like trying to get *73* magazine growing again in circulation and advertising. I sure need your help with this. Then there's my *Digital Audio* magazine, the *Green CD Catalog*, *Pico* and *Tele* magazines, five Instant Software computer stores and a mail order house around greater Boston, WGE Distributing, WGE International (importing), Green Publishing Institute, and a few smaller projects.

To these you add a number of new projects being started—magazines, new products and services—and perhaps you can appreciate why I don't have much time to answer letters.

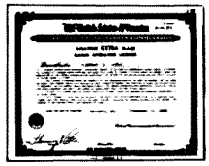
There are a few civic duties too, such as being a director of IDG, the largest computer publishing firm in the world, an overseer for RPI, a member of the N.H. High Tech Council and the FCC's Long Range Planning Committee, things like that. I don't have many boring days.

If you're interested, I'll tell you more about some of my upcoming projects. Who knows, you might want to invest in one or two. I seem to be able to make a lot of money, and I haven't much use for it for myself.

I was very pleased by the many hams who stopped by the booth to say they're getting *Digital Audio* magazine and enjoying it. You might mention it to your compact disc fanatic friends.

I want to thank everyone who said hello at Miami and wished me luck with getting *73* to be more interesting. It'll take a while, but just watch.

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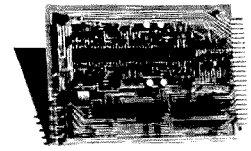
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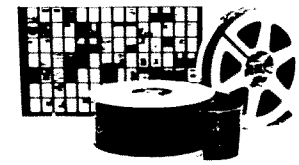
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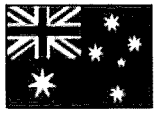
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73 INTERNATIONAL

Just because I started this column as a result of visiting DX hams is no reason you shouldn't put in your 2¢ worth and let me know what DX news you find most interesting. My inclination is to have DX ops tell us what they think is interesting—how we can get permission to operate if we're fortunate enough to visit—any coming DXpeditions—what's doing with repeaters—things like that. What do YOU find most interesting? Since we have a world hobby, I think you'll be as interested as I in what is going on. If nothing else, it gives us something to talk about on the air which, from what I'm hearing these days, can't hurt.

—Wayne.



AUSTRALIA

Jim Joyce VK3YJ
44 Wren Street
Altona, 3018
Australia

VK5—JAW'S HOME TERRITORY

Jaws, or The Great White Pointer Shark, has a reputation in most parts of the world for being a large fish, but in VK5, around Port Lincoln, world fishing records involving sharks have been broken time after time. There have been skeletal remains of the Great White Shark in this area recorded as being up to 60 feet long, and some fishermen swear that they are still around at near this length.

There is, nearly every year, some sort of White Pointer attack in these waters. Keep the above in mind as you read the following from Carol VK5PWA, the current president of LEPARC, giving a rundown on their Club Activities for this and next year. They offer an open invitation to call in on your way to the America's Cup, and will welcome with open arms any Americans, especially those from Orange, Texas, their sister state.

They are holding a Hamfest from October 11–13, with all the usual activities, with an added bonus of a trip at the end, for those interested, WX permitting, to the Dangerous Reef, the home of the world's White Pointers.

LEPARC—by VK5PWA

The Lower Eyre Peninsula ARC was formed in late 1978 and over the past years has grown to a membership of 25. Our early meetings were held in members' homes, but with the formation of the local State Emergency Service (SES), we were able to use a room in their building.

We helped them erect towers for joint use and we obtained our first lot of equipment with the help of the local Lions Club. However, within a few years the SES operation became much bigger than expected and we were asked to find alternative accommodations. Our local Council offered us the use of land adjacent to the SES compound and offered us a loan of $1,000 to help us establish our facility. We were fortunate in obtaining a caboose for our radio shack, and two disused guard vans for our workshop and storeroom.

We also acquired a 20 by 24 shed—donated, provided that we move it from its site! In March, '85 the concrete slab for the floor was laid, and Easter Monday found all hands on deck to stand our "new" building up. This structure has now been lined and the ceiling has been installed, together with an overwhelming number of power points. This room was unofficially opened with a flagon of port and paper cups at our June Meeting.

During late 1984 it was decided that as a club we should consider a special project for 1985, the joint celebrations of the WIA and International Youth Year. After discussion with some interested students, their schools were asked if they would like to have amateur radio as an elective choice for 1985. Naturally, we were almost killed in the rush, but we decided to limit the groups to 10 per class. The end result was two groups of year-10 students at Port Lincoln High, and one group of year-9 students at St. Joseph's Convent.

Term 1 was pretty solid—video tapes, lectures, and on-air sessions during the 11-week course. Term 2 has been workshop sessions, recognizing, testing and sorting components. They have also started on a construction project in two parts:

Part 1. A two-valve reaction radio receiver suitable for listening to broadcast and SW bands up to 30 MHz.

Part 2. Novice valve transmitter—CW+AM—to be assembled as a supplement of Part 1.

A prototype to receive 80- and 40-meter bands has been constructed and, although lacking in agc, was able to resolve all signals heard on an FRG7 receiver for those bands. Students will also take part in the forthcoming contests as 2nd Ops.

Term 3 will be more theory and, after the exams in November, the high spot of the year will be an expedition to Boston Island, a nearby offshore island. Equipment to be used will include the rigs built by the students and an early model rig built by Alf Treager (the father of outback pedal radio). Other equipment will also be used to fill out band coverage and thus ensure plenty of contacts.

The venue and dates still have to be confirmed as we are experiencing quite a number of problems. These are not new to anyone who has tried to organize a similar venture.

We have the support of the South Australian branch of the WIA and we have applied to the Department of Communications



Amateur Radio Live Across The Nullarbor—September 12, 1985. The Goldfields Amateur Radio Group (Kalgoorlie, Western Australia) welcomes V15JSA Railway Mobile. From the left, VK5AQZ (project coordinator), SWL 60370, VK5ZN, VK6ZGQ, and XYL Susan, VK6ZX and XYL VK6KYL, and (hidden) VK6ZAJ. Photos by VK5BPA.



Amateur Radio Live Across The Nullarbor—September 15, 1985. Graham Horlin-Smith VK5AQZ hopped out of his berth when the bands opened. (See the March, 1986, issue of 73, Australia column, for the story.)

for a special callsign, VI5IYY (International Youth Year). Between bouts with all this radio activity, the students are trying to come up with a suitable QSL card and T-shirt design. The Commonwealth Bank of Australia will sponsor the QSL cards.

So, listen out over the next few months—you may hear some of our prospective hams calling: "CQ, CQ, CO—VK5ALE VK5ALE VK5ALE—Second Opp Calling."

The Club has a Kenwood TS-520 rig, a 2m rig—and our RTTY machine is almost on air. Signals received do not have enough audio to be resolved on our Seimens Machine; we're busy doing a few adjustments, so it's really close to being "on-air."

We also have a bit of homebrew gear, including the ATU in fulltime use at the club. Antenna system includes Slim Jim and beam for 2m and a trapped dipole for other frequencies. We are working on a hat to load one of our towers as a vertical on the low frequencies.

Further club activities include a weekly club net on 3.560 (plus or minus QRM) at 0830 UTC on Fridays, plus a slow Morse session for VK5 division of the WIA on Monday nights.

If you are interested in a stopover or want further information, please write to LEPARC, PO Box 937, Port Lincoln, Australia 5606.

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island
Australia 2899

NORFOLK ISLAND

We knew we were playing for time back in 1976 when the powers that be decided to install an FM transmitter in the Norfolk Island broadcasting station.

"You won't need AM," they said. "This is a big step forward, keeping up with modern technology," it was maintained. Naturally, the people who made all the decisions (and still do) know little or nothing about SWL eager beavers and other interested persons straining to hear the elusive signals from VL2NI.

Some time during the second half of November, 1985, time ran out for AM broadcasting on Norfolk Island. The AM transmitter had ceased to function. The authorities did try to do something. They telephoned Papua New Guinea to talk with Jim VK9NS/P29JS to see if there was anything he could lend them in the way of equipment.

Personally, I do not think an amateur rig suitable for prolonged broadcasting, but then I am not a technical person. In any case, there was nothing Jim could do in the circumstances, and in a QSO with VK9ND on Norfolk Island, I learned that it had been decided to forego AM broadcasting from now on. So there we are. If you can't hear them on FM, you can't hear them at all.

Another leap up and away was the Aussat satellite which is now in place. So now there is only a dish standing between regular television and hardly any TV. Because it was possible to receive TV even before Aussat.

Jim and I used the six-metre beam for antenna, and during the summer months, TV pictures would come in in a ghostly sort of way: pictures fading in and out with two or three different stations intermingling. This interplay between stations could at times be quite hilarious. Best remembered is the voices of politicians seriously discussing a news item. The picture, however, showed muppets sitting around a table discussing something else. The scene was perfectly synchronized. The words of the politicians matched the movements of the muppet mouths to a tick!

Best TV program I have seen for years. It is doubtful if the satellite will provide good entertainment like that.

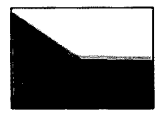
Amateur radio activity from Norfolk Island declined in November with a further 25 percent (myself) leaving the Island temporarily, the weather until then had been good for sitting inside playing with the radio. It rained almost every day from February onwards. And it blew.

The storm moved the beam so that the headings were all wrong. Not being crazy about climbing towers, I made up new headings on a piece of cardboard. The beam was roughly 135 degrees out. Africa? Where had Africa got to these days? Ah! There it was, up where the U.S.A. used to be. The U.S.A. had moved down to the Antarctic.

I was just beginning to get used to the new headings when a new storm moved the beam back to 45 degrees out. New headings. New confusion. I think Welikovski must have had a finger in the pie.

What with poor propagation and crooked paths in 1985, it hardly mattered. With so little activity and no AM broadcast, Norfolk has nearly slipped back into the dark ages, when few people knew of its existence. However, it does exist, Brigadoon-like. Sunning itself in cool temperate breezes out there in the Pacific.

The year 1986 should bring new awakening. Jim will be home to climb the tower. So we should emerge from the dumps of the sunspot cycle with Norfolk Island geared to communicate with the outside world once again.



CZECHOSLOVAKIA

Rudolf Karaba OK3KFO ARC
Gogol'ova 1882
955 01 Topol'cany
Czechoslovakia

UHF

During the contest "SNERA" that has been organized together with the magazine *Radio* and the Department of Communication of the USSR, the competing stations registered seven days in the course of July, 1984. During these days, polar glow with radio effects occurred. In August, 1984, there were eight and in September, 1984, as many as 14 days. UA9AAZ was listening to the station SM4GVF in the 145-MHz band at the distance of 2300 kilometers and RA3AGS was listening to the station PA and GM in the 433-MHz band.

RS I

(Radio Soviet ORBIT) According to the assertion of UA4FP, telemetry of the beacon RS1 in the frequency of 29.401 MHz can be heard from time to time. The directing centre in Moscow tries to also put the converter into operation but for the time being it was not successful.

SHORT WAVES

Every month in Czechoslovakia there has been organized a state contest in the band of 160m. The contest is organized for the increase of an operator skill under the title "Test 160." It is devoted mainly to young operators OK/OL. It lasts one hour by operating CW. In February, 1985 the first three places were occupied by these stations:OK1DWA—2,604 points, OK3CZM—2,552 points, and OL1BIP—1,825 points.

DXCC STANDINGS

The best stations in Czechoslovakia to March 10, 1985 (first figure, DXCC land confirmed, second, old DXCC): Mix (CW + Phone): OK3MM—315/355, OK1ADM—315/346, and OK1MP—314/345; CW: OK3JW—298/302, OK1TA—295/301, and OK3EY—295/299; Phone: OK1ADM—314/340, OK1MP—313/339, and OK1TA—310/325.

The champion of Czechoslovakia of collective stations on UHF for the year 1984, in which the results of the biggest European races on UHF are being included, became the radio club OK1KRG from Prague with 131 points; next were OK1KIR with 110 points and OK1KRA with 100 points, also from Prague, evidence their exemplary devotion to work on UHF.

RTTY

OK1VXO–OK1VVM have put into practice RTTY by using the micro computer ZX-81. The circuit of the contact between the computer, reception converter and generator AFSK is fit with the circuit MHB 1012, MH3205, MH7400, NE555. The program was worked out by Jirko OK1VXO.

From OK1JT I received further information on his experiment with the ZX-81. He uses the teletypewriter RFT only for the recording of the received relations. He assures the transmission by means of the micro computer and the program. For the interconnection of the computer, teletypewriter, tape reader and converter with generator AFSK, OK1JT uses the circuit of the contact according to OK2BFS. The operation program in the language Basic, that was elaborated by OK1JT, assures automatic transmission of calls, various texts from memory prepared in advance, printing of QSL sent by air, and, of course, transmission of the texts from the digit key strip ZX-81. OK1JT had no problems with mutual interference of the transmitter and the computer.

Annually the honoring of the best Czech and Moravian radio amateurs takes place. Late in January, 1985, the best radio amateurs meet in Tisnov to receive the prizes for their many years of service. The evaluation was done on the basis of the vote of the members of the Czechoslovak Central Council of radio amateurs.

The first place was occupied by a twofold world champion in radio

orientation races and a master of sports, Eng. Mojmir Sukenik with 270 points Pavel Sir OK1AIY received 183 points for his work on UHF and in third place was Eng. Karel Karmasin OK2FD for his work on short waves, with 166 points.

CONTESTS

In the VK/XL RTTY DX Contest, 1984, three Czechoslovak radio clubs achieved perfect placements in the category of collective stations, with multi-operator. They occupied the first three places in the world in this sequence: OK3KJF–110.000 points, followed by OK3RJB and OK3KXJ.

Besides that, listener OK2-21478 won the first place in the world of SWLs.

RTTY

Station OK1DRX not only improved its program for RTTY by means of a ZX-Spectrum computer, but by means of this computer made contact in the 145-MHz band with OK1VAT.

AMSAT OSCAR 10

Since the end of April till the beginning of October, 1984, Jenda OK2EH, by operating CW, made 150 contacts with 56 lands according to the DXCC list. He has been using electronic equipment of a multiplier type with electron tube REE3OB. The receiver is MWEc with a converter and the antennas are 12-element yagi for the reception and a 15-element yagi (or a spiral antenna with 10 threads) for the transmission. Both of them are revolving in both levels.

Radio club OK1KRA wrote that they had been working with the following Czechoslovak stations: OK1AIY, OK1KHI /p, OK1DIG, OK1KTL/p, OK1DKS, OK1DTL, OK2AQK, OK3AU and OK3RMW. Station OK1KRA is the first station from Czechoslovakia and the first one of the socialist states that had been working with 57 DXCC lands.

Some remarks made by OK1VPZ:

(1) It is necessary to listen perfectly, the antenna, 16-element yagi F9FT, or 2 by 9-element yagi F9FT crossed for circular polarization, with a preamplifier.

(2) Since there is an output of 20 Watts in the MHz, we have exactly the same as we need.

(3) As for the mentioned antennas, it is necessary to have exact prediction of the position of the satellite. It is best from the computer.

(4) If the signal of the computer is not strong enough, we call only weak stations, because if they have weak signals, they hear themselves and also us.

Over one and a half years, Ondrej OK3AU made in mode B about 2,500 contacts with 67 DXCC lands. Besides that, he had been working occasionally under callsigns OK5MIR, OK5KWA, and OK0WCY. Ondrej confirmed a sad reality—that unnecessary overloading of the converter in mode B has not been changing for the better. On the contrary, the number of stations using enormous erp outputs to the radar values in spite of improving their receiver system, has increased.

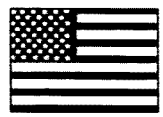
Vlasta OK2VPA from Opava has been also working through AO-10/B where he has made 100 contacts. She appreciates most the contact with the station VS6XLA from Hong Kong.

SATELLITES RS

At present, during the period of the quiet sun, there are good conditions for the work via satellites RS. At the beginning of 1985, OK3AU, OK3FH, and OK3ZFA were working regularly on them. Also stations from Bohemia and Moravia, OK1DJW, OK1BMW, and OK2AQK appeared. From time to time some unique stations with special prefixes EU, EO, EW, EV, station UA0KAJ from Kamchatka and the stations JW from Svalbard can be heard.

Michal OK2BXF from Brno made contacts with 28 DXCC lands through satellites RS. He made some contacts with erp-5 Watts (RS5). He heard himself back with 15 Watt erp, by means of today already outdated satellite RS6.

According to unofficial information, new satellites RS9 and RS10 have been successfully tested in Kaluga near Moscow. The satellites are equipped with two converters, 145/29 MHz and 21/29 MHz.



GUAM

Edward L. Campbell KB6DAW/KH2
300a Rendova
APO San Francisco CA 96334

I thought I would write a little about the Island in this column, with a little on the lifestyles and some history.

Guam is a small island, 30 miles long by 12 miles wide—about 225,000 acres. It has a population of about 175,000 with 20,000 being transient with the military.

Guam is know as the hub of the Pacific. It is a major link to satellite communications in the Pacific with a NASA tracking station. Guam is 6,000 miles from Los Angeles, 3,644 miles from Honolulu, 3,500 miles from Singapore, 3,000 miles from Manila, and 1,550 from Tokyo.

Guam has two types of seasons, wet and dry, the wet season being from July to December. Guam's average temperature is 86 at its high with its low being about 75. The yearly rainfall is about 85 inches. During the rainy season, Guam is lush and green.

The highest point on Guam is Mt. Lamlam (1336 feet), in northern Guam, with undisturbed jungle.

At the north end is Andersen Air Force Base, and at the southern end is Apra Harbour and the main Naval Station. Speaking of the southern end, there is a small island known as Cocos Island. It is about 2.8 square miles and is a large tourist attraction with a hotel and sandy beaches. It also has a small zoo with tropical birds and other wildlife.

Guam is part of an underwater mountain chain that includes Japan.

The people of Guam are a mixture of Chinese, Japanese, Koreans, Filipinos, Micronesians, and of Spanish descent, and also us statesiders. The Guamanian people are know as Chamorros (the women are Chamorritas).

Guam, after many years of rule by the Spanish, became a US Territory, after the Spanish American War and the Treaty of Paris, 1898. In 1950, the Chomorro people were given their citizenship by Congress. In 1971, Guam elected its first delegate to the US Congress.

Guam is a duty-free place for tourists, with some of the prices being 50% lower than stateside prices.

There are about 100 hams on Guam, with many not active. Sixty are in the Marianas Amateur Radio Club (MARC) of which I am the secretary.

To finish up, the island is a laid-back type of place with lots of water sports, good prices for the shopper, and pretty decent propagation for the DXer. So if you get the chance, come by and see us.

Here are a few lines on my trip to Wake Island and thanks to those who helped: P29JS for the vertical and headset donated by the HIDXA and the 220 net; AH9AC, who helped me plan and coordinate plane schedules and the use of some of the equipment; WH9AAD, a Novice on the island who was in charge of the "motel" there, who made sure that I had a room to myself; the communications officer who allowed me to use the facilities; of course the Base Commander, Maj. Westmoreland, who gave me permission to visit there and who might try to help me with the next trip next year; NK6T for the use of his rig during the CQ WW while he was off to Japan, and KC6RM for his help putting up the vertical for the lower bands—and his technical work on the rigs to keep me up on the air.

My call has been changed from KB6DAW/KH2 or KH9 to AH2BE, which will be AH2BE/KH9. That will make things a little easier since it is shorter.

Now all in all, I made 6,200 QSOs. 122 countries, all the states, and all but 4 zones. So not too bad with only 7 days on the air. The first two days were getting the rigs and antennas up and on the air, so that the following days would be nothing but air time. I did not have an external vfo so a lot of the 40-meter split work was by running back and forth from 7.085 to 7.195 on one vfo. It was slow but it worked.

Mostly I used an FT-101b that I borrowed from KC6RM; I finished up with a TS-830S. The 830 had some receive problems—that is why I used the other rigs. Gary NY6M was supposed to go, but he made a stripe and his officer had other orders for him, so he could not go. I had to go by myself. Next time I will make provisions for that and have two people in line to go with me. If Gary had been along, we would not have left so early and could have doubled the number of contacts made. But all in all, the trip was a success.

Propagation was excellent to all areas except Europe. I hope the next trip will be more fruitful for them. I am also planning to do a two-band-a-day-only schedule so that each band will get as much time as possible. And also hoping to get up on the top band so that 160 will get some attention.

Anyway, I got on the island on the 23rd, their time. After about an

hour I was on the air. My first contact was HC8E. Not a bad way to get started! Then checked in to the 220 net. It was open long path to Europe at that time, and had problems staying on the net because of the QRM.

After the net I went to the 7.085 net with Eric ZL3AAG, but the band was very noisy—as was 75 meters. In the Pacific, the lower bands are very noisy as a whole. My best two bands were 20 and 40, though. As the days progressed I did also the QSOs. I was always in a pileup which made it hard to call some of the stations that I needed. My country list would have been greater otherwise.

I left on the 31st of October on a plane on its way directly to Guam. My voice was gone. I was getting only five hours of sleep a day. (Except after the contest, then I slept 18 hours.) I worked all but four hours of it. AH9AC did that part for me.

Now I did have some fun. I had a four-day stopover on KH6 and worked a few people on 2 meters. I did not know there were so many repeaters in such a small place HI HI HI. . .

Also while I was enroute, there were some interesting things happening. It just so happens that the same month was the 50th anniversaries for Amateur Radio and the first China Clipper flights from the states to the Far East. So lots of celebrations on the island. So for amateur radio it was a small milestone.

For those I made contact with, I hope you have sent for your cards for this event. If you haven't, please do so as soon as possible. I will be packing my bags to go to HL9-land soon and I want to make sure that you get yours. And an SASE would be appreciated. It makes things go faster.

I have a small trip to 8P6-land planned while I am there visiting my inlaws. My father-in-law is 8P6JQ. I will be as active as possible from there. I hope to have an 8P9 call. You will find me on the PHO net or the 220 net with P29JS—or should I say VK9NS?

I am trying with the help of HL9TW or HL9CW to have my HL9 call before I leave Guam so that I can get out the word in advance. I hope to get HL9MM. And am still planning to return to KH9 next year.

As of this writing, almost three years as a ham, I have contacted over 230 countries with 195 confirmed. And I hope those I have sent cards to will return them to me as soon as possible so I can put them in for my DXCC.



GERMANY

Ralf Beyer DJ3NW
Opferkamp 14
3300 Braunschweig
Federal Republic of Germany

SPACELAB-D1 MISSION

In November, 1985, space shuttle Challenger carrying the German Spacelab-D1 mission landed again. But even today one cannot fully assess all the outcomes of this mission for the amateur-radio community.

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Astronauts were Reinhard Furrer DD6CF, Ernst Messerschmidt DG2KM, and Wubbo Ockels PE1LFO. Here are some of Messerschmidt's comments. Regarding his amateur-radio activity in space, Ernst said: "I think I made only a quarter hundred QSOs because of the immense program of work we had to do. The transceiver was just sitting there and I had a chance to hit the button when only I passed by. However, I enjoyed it very much that every time I turned the radio on someone was calling us. Even over the Pacific. I asked someone from the space shuttle crew whether he would see any land or island—but no. Probably the call came from a ship out there."

Regarding the pileups, Ernst commented: "Of course, the pileups were roughly proportional to the amateur radio population of the area we just flew over."

A demonstration of what he was talking about was a tape recording which was incomprehensible sometimes due to the European QRM. But some minutes later, it reproduced the only voice of a station calling from South Africa, and nothing else. A total of 12 hours of tape recording was brought back.

Unfortunately, the astronauts did not manage to get in contact with DP0GVN, the German amateur radio station of the Georg-von-Neumayer base in the Antarctic. The station was operated by Lothar Baumann DG5SL, at that time—who can be heard regularly via OSCAR 10 and who tried hard to catch the Spacelab station. Better luck next time!

Ernst's comment on the importance of amateur radio in space: "Every time I heard the voices calling us I had the good feeling that we were still in contact with someone on the ground. I consider amateur radio a great leisure activity, in particular for the personnel manning the first space station in about 10–12 years from now. Another aspect is to think about amateur radio activity from an orbiting space vehicle via geostationary satellites. That could keep us in contact with all continents permanently and would enhance our chances to set up schedules which fit better into our program of work."

The amateur radio activity aboard Spacelab-D1 received particular good attention in the media here in Germany. There were dozens of newspapers reporting from their local amateur radio station on the tracking, calling and receiving at least the beacon of the spacelab amateur radio station. The subject was also very well covered in a 45-minute TV report with truly professional recordings and film clips of the astronauts talking from Spacelab via amateur radio and of their counterparts on the ground.

Besides the many positive experiences, there were the ever-recurring problems of handling large pileups and the nuisance of stations chatting on the transmission frequency of the astronauts. A thorough analysis of the state of the art of working through conventional DX pileups and an attempt to derive procedures applicable to space communication may be worthwhile. Furthermore, the multi-channel, fixed frequency, and separate transmit/receive features of space communication may lead to completely different and perhaps more advanced solutions of this problem. Bright ideas are badly needed, in particular in the light of the Spacelab-D2 mission coming up in 1988.

"Bright ideas will always get our support, in a way we helped amateur radio to become operational on Spacelab-D1," said Heinz Riesenhuber, secretary of the German Department of Research and Technology.

All right, it's up to us again.



INDIA

Miss R. Subha
3 Thiru-Vi-Ka Road
P.B. No. 725
Madras 600 006
India

HAM AT THE HELM

Prime Minister Rajiv Gandhi VU2RG has been in power for just over a year, having succeeded his mother, Indira Gandhi, on 1st November 1984. This period has seen an extensive change in the policies of the government which have even won the grudging appreciation of the opposition. Quite a few of these are of interest to hams.

While he was a member of Parliament in 1984, Rajiv was responsible for the waiver of customs duty on amateur equipment, with a limit of Rs. 10,000 (roughly US $1,000) which was expected to cover all but the most sophisticated transceiver. The waiver was valid till December 31, 1985. Prices have been going up along with sophistication, and there are many pieces of equipment that ten thousand rupees cannot buy any more. Responding to representations by the Federation of Amateur Radio Societies of India (FARSI) and others, government has now extended the validity of the waiver till the end of 1986, and has enhanced the limit to Rs. 15,000, making it possible to bring in any equipment that one might fancy.

The Indian electronics industry had enjoyed a sheltered market dominated by the favored few who had been given industrial licenses to make electronic products. One fine day, the Prime Minister made a statement in Parliament, indicating imminent relaxation of these restrictions. What followed was a wholesale liberation of the industry from its shackles. The electronics industry has not yet responded to this move with any tangible results—reduced prices or better products. The Prime Minister recently warned the industry to take heed that Government will go to any extent to see that the benefits of liberalization reach the common man.

Rajiv Gandhi has also swerved from his mother's policies about the computer industry. At one time, Indians returning from tours abroad could sneak in computers only by making customs officers believe that they were video games or electronic typewriters. Today, one can bring in a personal computer valued up to US$300 without hassles, by paying the appropriate duty on it. The Indian computer industry (where the Sinclair/Timex ZX81 with 1K RAM once sold for over US$500) has also benefited by reduction of import duty and liberal import of components and peripherals. Almost anyone who proposes to make personal computer or microprocessor-based systems is given a license to go ahead. It is the Prime Minister's wish that computers should become as common in Indian schools and households as they are abroad.

Government has also recognized that young engineers bubbling with enthusiasm can produce dramatic results. To illustrate this concept, a centre for Development of Telematics, C-DOT for short, was recently formed with a few hundred fresh graduate engineers under the leadership of a couple of US-returned Indian engineers, charged with the development of an electronic telephone exchange. This group has, within a year, produced an excellent electronic PBX and is forging ahead towards its ultimate goal. It is likely that more such goal-oriented young-engineer projects, including amateur-radio and personal-computer hardware, will be promoted either by the Government or with its blessings, thanks to VU2RG.

JAPAN INC.—THE INDIAN COUNTERPART

A reader in the "Feedback" section of *Radio*, India's only amateur radio journal, has written "I would be happy if you include an article on how to import a rig from abroad on our own as the dealers of Japanese companies in India keep a good profit. So just to prevent their monopoly and help the hams of India, it is a must for every ham to know how to import the rigs. Some of the ham friends outside India can give us their rigs or arrange the rigs on a no profit, no loss basis.

This statement might sound rather harsh, but there is quite some justification for the reader to feel bad.

Ever since import of amateur equipment was freed from import control in 1980, local representatives of Japanese manufacturers have created an impression that used equipment is not permitted to be imported under Open General License (OGL). Five years and several clarifications later, these agents continue to din into the ears of prospective purchasers that they are not permitted to import used equipment.

Most amateurs who did not want to take chances, fell for this canard and refrained from importing used equipment, just to avoid the hassles that the doomsayers assured them were bound to bog down their rigs at the customs.

Concerned with the small number of persons who were on the air even after import restrictions were relaxed, Government went one further and fully waived import duty. The agents went into business again spreading the word that those importing used equipment will not be eligible either to duty waiver or free imports.

Not satisfied with the 20 to 25 percent commission that they get from the manufacturers, they add "handling charges," cable charges, and incidental expenses adding up to at least a further 10 percent of the cost of the rig. The fast appreciation of the Yen also gives

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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20					15					
ARGENTINA									15	15	15	
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		50	80	40	40	40	40	20	20	20		

G=Good, F=Fair, P=Poor.

Look for some disturbances in magnetic field between 5th and 10th with possible storm levels; also possible 6- and 2-meter openings in this period. Again, between the 27th and 30th look for active magnetic field conditions and generally poor propagation on HF, LF, and VHF.

APRIL

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 G	3 F	4 F-P	5 P
6 P	7 P	8 P	9 F	10 G	11 F-G	12 F
13 G	14 G	15 G	16 G	17 G-F	18 F	19 F-G
20 G	21 G	22 G	23 G	24 G	25 F	26 F-P
27 P	28 P	29 P	30 P			

them the opportunity to ask for some more in the name of currency fluctuations. Airfreight adds US$120 on a Yaesu FT-757GX, the most popular import in India.

A number of amateurs ask why the Japanese manufacturers will not ship by other modes. The agents say their principals will not change their policy. Take it or leave it! And they help the swing towards "take" by adding that the duty waiver will not be extended.

It has been extended thrice, and the new deadline is December 31, 1986, with reasonable chances of further extension.

What recourse does the poor Indian ham have? It has to be conceded that amateur radio has today become an appliance operation the world over. India is no exception. If amateur radio is to keep growing, appliances have to be made available *without* the added cost of Japan Inc.'s local arm.

Short of switching his allegiance to the only US-made transceiver which has fewer knobs and features than the Japanese stuff, Mr. Indian Ham has to live with the problem and educate himself on the intricacies of the import control and customer laws and procedures. To what extent this can be accomplished remains to be seen.



LIBERIA

Brother Donald Steffes, C.S.C.
EL2AL/WB8HFY
Box 716
Notre Dame IN 46556

Ninety three and a half inches of rain in five weeks! That was the recorded rainfall in Monrovia that was reported on The West African Net early last September. Until then it had been a very *dry*, wet season! The accumulation was running more than 20 inches below the lowest records of the past four years!

The antennas were well washed but communication was bad. Even 40 meters (which is our "workhorse" band for calling up and down Liberia) sometimes goes almost to zero. DX communication was worse and we expatriots were feeling very lonesome as we talked to the stratosphere and got no answers.

In the meantime, the repeaters were working. In an earlier column I wrote about our plan to link the Monrovia and the Bong Mines repeaters. They are linked and we have HT communication from both ends. We have never had it so good.

Now Mark Munson, M.D. EL5G has come back with another repeater. Plans are under way to install that little one-Watt unit in the Zorzor area which is near the north end of Liberia and link it with the two repeaters down here. The distance is 90 miles to Bong Mines and 120 to Monrovia. If it is necessary they will use a linear and when everything is working we will give a full report in this column.

Mark is a missionary serving a 120-bed hospital in Zorzor, and once a month he travels another 100 miles to Foya to bring the service of a doctor to the hospital there. When Mark has his new repeater working it will give him regular and easy communication with Monrovia. The radio is his only means of contacting the world outside.

The amateurs in Liberia enjoy a great deal of freedom and the missionaries working in this country use it to great advantage. When they come to begin their tour of duty, the amateur license is high on their list of priorities, and the Liberia Radio Amateur Association does everything that is possible to help them.

In the States there are many nets that are organized and exist for the sole purpose of serving American missionaries or armed service personnel. They do this with great dedication and sacrifice on the part of their members. It seems to me that an article recognizing their contribution and listing the times and frequencies at which they operate would be in order. Such an article would increase an awareness of this work, and in all probability many American amateurs would offer their expertise and join one of these nets. At the same time it would serve as a kind of a directory for those that need the help of these nets.

So long as our amateurs show themselves to be responsible and use the amateur bands in accordance with the law and accepted customs we will continue to enjoy this freedom. Every effort is being made to ensure that this be done and it is a rare instance when a correction has to be made.

Note from the International Editor: Don EL2AL has left Liberia. We will miss the interesting reports he so faithfully sent us. Anyone like to fill his shoes?

HAM HELP

I am in the U.S. Navy stationed in Japan and I'm looking for a good used linear amp, 250 W and up, preferably for 10–80 meters, but I'll consider any HF amp.

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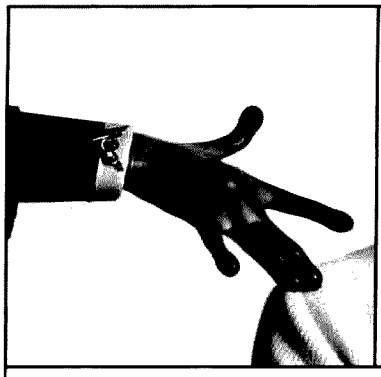
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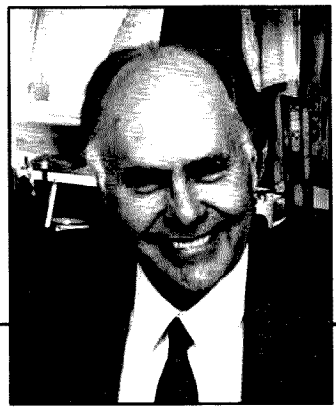
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NEVER SAY DIE



THE RIGHT TO LISTEN

If it weren't such an obvious sign of our dumb bureaucracy running amok—giving me even less confidence in congress than I already have left—which isn't much—this craziness over listening to the radio would be one heck of a joke.

Take the million or so people who've bought satellite dishes. For several years now they've been rationalizing their listening to signals intended for cable distribution by telling the rest of us that, what the hell, if the industry doesn't like us buying a system and tuning in to their satellite feeds, why don't they encode them? Fine, I bought that concept.

Now (hold your chair for this one) the satellite dish owners are up in arms, bringing suit against the cable people, trying to force them *not* to encode their transmissions. What kind of nut cases do we have out there? And I certainly don't put down the lawyers who've clustered to fight for this incredibly stupid premise—they're the only ones who can't lose.

Which brings me to the telephone, that revered instrument of confidentiality—the instrument the cellular crowd is trying to make safe for democracy. What a bunch of guano. Firstly, if you know anyone who works for The Phone Company, just ask them about telephone privacy. There *is* no such thing. I've had many telephone people tell me for years that The Phone Company has always made it a practice of listening in randomly to phone calls. Sure, all these people could be lying—and so could the underground telephone newsletters which say the same thing.

Okay, let's say that TPC absolutely doesn't do any such horrid thing. Next in line, unless you've been completely tied up jamming 40-meter service nets for the last few years, is the fact that much of the telephone traffic is sent over microwave links. You also are well aware that Russia has oddly enough set up listening points near many of these links. They have the technology to not just listen in to almost any phone call they want, they could easily record everything and have a computer sort through zillions of calls looking for specific numbers or key words.

How many years have we been using cordless phones? Several. Well, I suppose there are some people who are so dense that they don't realize that every word they say can be heard for a considerable distance by anyone with even the slightest interest—or the willingness to waste his time listening.

So now comes cellular radio and, surprise of surprises, anguish that radio signals aren't private. Gee, who would have ever thought someone could buy a radio and tune in to radio signals? Let's make it illegal to make radios. No, I guess we've got to let 'em make 'em, but maybe we can make it illegal to buy them. How about making it illegal to use them? Sure!

So here we go again, right into a legislative mess far beyond anything the simple congressmen involved ever imagined. Okay now, we've got to prevent people from listening to cordless phones—that means we've got to stop people with broadcast radios from tuning the high end. Perhaps we can make it obligatory that every broadcast radio have a miniature alarm transmitter which would trigger automatically when the dial is turned to the high end, alert-



"We're glad you're interested in the apartment! There's one small problem, though . . . a 100-foot tower in the back yard!"

Continued on page 10

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Packet Reprieve

THIRD-PARTY TRAFFIC sent via packet radio is legal, at least for the time being. Last month we reported that the Federal Communications Commission had nixed using auto-forwarding systems to transmit third-party traffic. The FCC, in effect deciding that the medium by which a message is sent is not important, stated that a control operator must be present every time a third-party message is passed. The FCC has granted an ARRL Petition for Extraordinary Relief which will allow store-and-forward automatic message handling to continue until a final decision on the matter is made later this summer. Specifically, the waiver allows automatic transmission of third-party traffic using AX.25 (or compatible) protocol on frequencies above 50 MHz. Also, the FCC warns, "Control operators. . . capable of monitoring AX.25 packet transmissions must be alert to the increased dependency upon them for monitoring during the period of this waiver. We call upon them to immediately make known to the responsible control operator of a station retransmitting communications under automatic control any misuse of the station so that the control operator can take prompt corrective action." The FCC will be watching us closely. Our behavior during this waiver will undoubtedly be considered when the commissioners make a final decision on automatic third-party packet systems.

Big Hit

THIS MONTH'S discussion on the **National Teleconference Radio Net** will focus on lightning and power surges. Ed Bellamy and Bill Paulin of Lightning Elimination Associates will host the program. Charlie Kosman WB2NQV will also speak on the upcoming "Hands Across America" project in which six million people will form a living chain stretching from coast to coast. Charlie says that 4,300 hams are needed to coordinate security and safety teams. The NTRN will start at 8 p.m. CDST on May 1, 1986—contact your local repeater guru to find out which machine in your area will be connected.

Harry D. Hooton

***73*'s GOOD FRIEND** and longtime antenna expert,W6TYH, passed away on Christmas Day, at the age of 74. Harry loved antennas and authored numerous articles for *73*. He also wrote the *Single Sideband Book*. In a typical Hooton *73* spectacular, Harry lightheartedly described how he brought down a stubborn wire antenna with a couple of blasts from a 12-gauge shotgun, much to the delight of the crowd of neighborhood children gathered to "help." Despite his poor health in the last few years, Harry continued to "round up the kids" to test antenna designs; when the antennas worked, he sent us the plans. (If they didn't, ka-boom.) In the true ham tradition, Harry's antennas were always a complicated system of pulleys, buckets of sand, and miles of wire set up at precise angles. I'm sure he factored in tree growth, too. We at *73* knew Harry only through his work, but his articles didn't hide his humor and his kind nature. He wrote several of his last articles for us while bedridden, and it is only as his key falls silent that we realize how much we'll miss Harry Hooton.

CIA Maps

IF YOU'RE NOT SATISFIED with what the State Deparment has to say about a country, why not try the CIA? **Phil Spotts** offers a series of color "intelligence" maps which point out geographic features, industries, crops, land utilization, population density, rail lines, roads, airports, and seaports for the nations of the world. The maps are $10 apiece—get in touch with Phil at Best Press Services, PO Box 27073, Phoenix AZ 85061. Send an SASE for a list of available maps.

RFI Update

FROM CANADA come more details on the trial and tribulation of **Jack Ravenscroft VE3SR.** Last year Jack was sued by his neighbors, Tim and Dale Houghtby, who claimed that Jack's amateur radio interfered with their electronic organ and their microwave oven. The Canadian DOC examined Ravenscroft's station and pronounced it "clean." In court, the plaintiffs produced a tape of the interference caused to their organ—and were surprised to learn that the CW had come from VE3OAI, a ham living about 500 feet away from the Houghtbys. Also, the microwave oven that turned on and off of its own accord was fixed when defective components were replaced. Ravenscroft's defense centered around the fact that consumer electronic equipment is simply not immune to rf interference.

Branching Out

FOR YEARS hams have talked about using trees as antennas, and some experiments have shown promising results. Now a West German radiation expert reports that rf can adversely affect trees; he claims that radio waves can decimate forests. The researcher says that leaves, needles, and branches are stressed as they act as mini-antennas, and the stress kills the tree. The foliage also confuses microwave radiation with sunlight, causing the tree to think that the middle of a winter night is the height of a summer day.

TNC Fix

IF YOU OWN a **TAPR TNC-2** or an **AEA PK-80,** listen up. Both of these models use resistor R98 (4.7k Ohms) to provide a software-readable input from the modem. SIO IC U22 provides a pulsed output on the same pin that R98 is connected to; there is a chance that the state machine's operation will be interfered with. To fix this, just replace R98 with a 100k-Ohm resistor.

ACTS Axed

AMSAT'S HOPED-FOR ride into geosynchronous orbit aboard NASA's ACTS satellite is a no-go. It looked as if room aboard the new bird could be made for an OSCAR Phase IV system, but ACTS Program Manager Dan Brandel vetoed the plan because the AMSAT transponder might not be compatible with the ACTS satellite.

Big Bear Base

LOOK FOR KDØDJ/HR3 in Honduras through June. The station, located at base camp Big Bear, near Yoro, is manned by **Chief Warrant Officer Jim Roberson** and **CWO Don Hayes.** The two are on a road-building training exercise, Operation General Terencio Sierra-86, and are attached to the Missouri Army Nation-



CWO Jim Roberson operating KDØDJ/HR3 near Yoro, Honduras.

al Guard. Jim is a UH-1 helicopter pilot with the 135th Engineer Support Group and Don is the Task Force Maintenance Officer for the 203rd Engineer Battalion. The station is operated a few hours per day, mainly for stateside phone patches, on 15, 20, and 75 meters.

Out the Hatch

THE SOVIET UNION has replaced the aged Salyut-7 space station with a new, larger one called Mir (Peace). After an automatic shakedown of the orbiter, the first cosmonauts to occupy the new platform were sent up in a rare, nationally-televised launch. It is very likely that the cosmonauts will manually launch **ISKRA 4**, a small amateur satellite with an uplink and downlink in the HF bands. "Manual launch" means that the satellite will be dumped out through Mir's garbage disposal system. ISKRA 4 will have a low, circular orbit that will rapidly decay. Mir is in an eccentric orbit, 307 by 185 km, and you should be able to see the space station as it orbits the earth. A side note: There have been reports of voice communications from Mir on 143.625 MHz.

F2A Okay

A TEN-METER REPEATER can legally identify itself using F2A, thanks to a recent amendment to section 97.61a of the amateur rules. The FCC also changed other sections of Part 97 to indicate F2A authorization wherever F3E repeaters are allowed. The commission had apparently forgotten to include the mode when new emission charts were drawn up. (If you don't know what all those numbers and letters mean, send for *73*'s Genuine FCC Emission Clarification List—it's free for an SASE sent to *73* Magazine, WGE Center, Peterborough NH 03458. Attn: Emissions.)

No Way, Lee

LEE SHOBLOM K6ADA has been denied his request to use portions of the amateur 440-MHz band for news-gathering. Shoblom had asked that he be allowed to use amateur frequencies and equipment to send ATV pictures from remote locations back to his studio, citing the high cost of commercial gear. The FCC agreed with the ARRL and others that the proposal was contrary to the principles of ham radio.

Gun Jumping

WISHFUL THINKING DEPARTMENT: I jumped the gun last month, reporting that two new Soviet satellites, RS-9 and RS-10, had been successfully launched. The mysterious telemetry on ten meters, thought to be coming from the new birds, has been positively identified as emanating from RS-1. RS-1, which has been useless for amateur communication for several years, occasionally pops to life briefly when its batteries charge up. The two new satellites are still undergoing ground tests and are expected to be launched later this year.

Royal Ham

CONGRATULATIONS to His Majesty King Hussein JY1 of Jordan and Her Majesty Queen Noor JY2NH on the birth of their fourth child, **Her Royal Highness Princess Raya JY2RBH.** Speaking of birthdays, 56 Jordanian hams worked nearly 56,000 stations during an on-the-air celebration in honor of HM King Hussein's 50th. Mohammed Ali Nugrush JY4YJ cranked out around 800 QSOs a day for a total log of 11,600 stations, and was awarded a giant silver trophy for his effort by His Highness Prince Raad Bin Zeid JY2RZ.

UK on Six

NOW THAT SIX METERS is available in the United Kingdom, activity is mushrooming there on 50 MHz. The *RSGB News Bulletin* reports plenty of stations to work, most of them running CW. Other countries with new six-meter privileges include Ireland, where 20 special permits have been issued to Class-A license holders (including EI2W, EI9D, and EI6AS), and Portugal, where CT1WW has a 50-MHz permit and is running 3 Watts.

Beacon Bulletin

A NEW TWO-METER BEACON is now operational in Iceland. TF8VHF is on 144.939 MHz, running 40 Watts to a six-element yagi up about 50 feet. The antenna is pointed roughly east.

World Notes

JIM SACKEY N9ESM sent us an interesting package describing "Background Notes," a publication of the U.S. Department of State. Each Note is a summary of information about a single country, such as geography, government, and economy. A map of the country is also included. About 170 Notes are availble at $1 each ($42 for the entire set), or you may subscribe to the series for $32 per year. (The Notes are updated every two years, and a one-year subscription includes around 60 Notes.) Jim points out that "Background Notes" are a good way to learn more about the countries we contact on the air. You can get more information about this publication by calling the Government Printing Office at (202)-783-3238.

Hamfest Help

CHRIS SULESKE N4LZG writes with help for the weary hamfester who wears his faithful HT on his belt. Concerning the rubber duck antenna: "First, connect two BNC ninety-degree angle adapters together. Attach the male end of this combination to the HT. Attach the female end to the antenna; you now have a pivot which angles the antenna downward over the side of the HT. I find this useful in keeping the duckie out of my armpit." Thanks, Chris.

Bar None

THE BIG WINNER in *73*'s Name That Bar Contest ("Fun!," April, 1986) is **Pete Louzader N1CTV.** Pete sent us not one, not two, but *three* separate Western Union Mailgrams, plus electronic mail via CompuServe! In the first Mailgram, the winning entry, Pete describes the bar and its environs: "The 73 Bar and Restaraunt is located at 73 New Street in the Wall Street area of New York City. New Street runs from Wall Street south to Beaver Street...the street is narrow... about 18 feet curb-to-curb. The sandwich shop [next door] is The Sandwich Genie at 69 New Street. Also in this area are the Drago Shoe Repair Shop, the Silver Stars Deli, and the Beaver Key and Lock Shop." Pete is the Director of Facilities Engineering for Automatic Data Processing, Inc., and wins a one-year subscription to *73* for his sharp eye and dry throat.

NK6K > Packet

A NEW PACKET-RADIO COLUMN premiers in this issue of *73* on page 86. "NK6K > Packet," conducted by **Harold Price NK6K,** will explore current trends in packet radio and serve as a national sounding board for the packet community. Harold's name and call will be familiar to packeteers: He has been a major player in the development of amateur packet radio. In fact, Harold participated in the very first on-the-air contact using AX.25 protocol. He also is one-third of the team which wrote the software for TAPR's TNC-1. Welcome to *73*, Harold!

Read Heard

HEARD ISLAND ODYSSEY, a new book by "*73* International" correspondent Kirsti Jenkins-Smith VK9NL, is now available in the United States. The book chronicles the adventures of the Heard Island DXpedition led by Jim Smith VK9NS. Copies are $12.25 (Ohio residents add 6% sales tax). Contact Ron Pretekin AB8K, 6741 Oak Field Drive, Dayton OH 45415.

QSP

"QRX" comes to you this month courtesy of MSgt. Sheldon Daitch WA4MZZ, *The Shortwave Magazine*, *The JY Newsletter*, *Sweden Calling DXers*, *The RaRa Rag*, and *Amateur Radio News*. Send your news and photographs to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: QRX.

NEVER SAY DIE

from page 4

ing our new Radio Police Force to home in and read the perpetrator his or her rights.

But what about those spies who are tuning into microwave telephone relays? Well, they're going to need a dish or other microwave antenna, so let's make everyone register all microwave antennas. It shouldn't take more than a staff of 50,000 and a budget of $1 billion a year to handle that one. Of course that won't stop the spies because they'll have their antennas within their embassy compounds, beyond the reach of our laws and registration.

Now, what about cellular? Same thing. Let's have every radio capable of tuning those frequencies or being modified to tune those frequencies registered. We'll also have to register the sale of parts because it's so easy to build a small downconverter which would let you tune those frequencies on a low-band rig. I think we'll need a little bigger budget for this one—maybe $5 billion will handle it. But heck, that's no more than the cost of an extra shuttle or three toilet seats for Air Force One.

You know, we haven't even begun. What about the low lifes who are tuning in those new telephones in commercial planes? And the millions of marine telephones? Come *on*, congress—a fine mess you've gotten us into!

CALL THE FCC!

Here's a news flash for you: The FCC is sick and tired of being called every time a ham somewhere gets upset over some terrible thing another ham is doing. Hey, is amateur radio supposed to be self-policing or isn't it? Well, the fact is we're supposed to take care of ourselves and not keep pleading for Big Brother to come in and do an A-Team job on your local jammer. . . or whatever.

In case you haven't a good grasp on the FCC's role in our hobby, let's look at the situation. I find, in my talks with clubs, that many amateurs have a weirdly distorted view of the FCC and its relationship with us.

Try thinking of the FCC as a benevolent bureaucracy—one which has our best interests in mind, but which has both hands and one leg tied by a shortage of funds. It hops around on one leg as best it can to help us out, despite its severe limitations.

The FCC has some very large problems with which it's trying to cope. The whole telephone situation has come unglued as a result of the Bell breakup. Thousands of new firms are fiercely fighting to get pieces of this restructuring, with the FCC having to decide for or against their survival at every turn.

Add to that the increasing legal problems with satellite communications such as the thousands of firms selling earth stations to homeowners on the basis that it's legal for anyone to receive TV signals. . . after all, if the cable people want to keep you from receiving their programs they can encode 'em, right? Now the same bunch is trying to sue the cable people to stop them from encoding their programs on the basis of the investment people have in earth stations.

And so it goes. Communications is up by about two orders of magnitude in the last generation, yet the FCC has been forced to cope with this escalating mess with less and less funds. They need some ham bitching about a repeater jammer or an errant CBer like we need a solar flare radio blackout.

Another thing they really look forward to is the continuous dribble of ill-thought-out petitions for rule changes. These things, which we think are of world importance, are so far down on their scale of priorities that I'm sure there are many people at the FCC who wish we'd just shut up and go away.

The FCC budget cuts have virtually eliminated their monitoring functions, so there's really not much they can do to help us put some jerk ham out of business just because he's causing intentional interference. Heck, I doubt if the entire FCC monitoring division, if brought in from all over the country, could make a dent in our L.A. jamming problem.

Okay, if we're living in a dream world when we think we can turn to Big Brother to fight our fights for us, perhaps it is getting time to adjust to reality and come to grips with it. You know as well as I that we don't need the FCC. There isn't one single thing the FCC is doing right now which we can't do better ourselves, once we face up to it. A whole lot better.

The strength of amateur radio, to my mind, lies in the local amateur radio clubs. As the saying goes, in union there is strength. The excesses of American worker unions has tainted the word union—wherever there is power there will be people anxious to abuse it. That's not currently a problem in amateur radio, but it has been in the past and, mark my words, it will be again.

If we want to improve amateur radio, our best course is to strengthen our club structure. The first step then is to get more hams to join ham clubs so we'll have the club strength we need to be self-policing. Next we can aim at being self-determining, but we can't achieve the second until we've managed the first step.

Club Growth

The big secret in making a ham club a success is both simple and complicated. It goes with—and flies against—human nature. The simple part is the basic rule: If you want to have a successful ham club all you have to do is make it fun to be a member. Oddly enough, most people—and that, to a large degree, includes hams—prefer fun to boredom. People love to get together and lie to each other. Perhaps you've noticed the popularity of parties? Yep, if you pattern your ham club meetings after parties, you're going to have so many members you'll have to find a new place to meet.

There are good parties and bummers, so just making a club meeting more like a party isn't necessarily going to do it. The key to a successful party is making sure that everyone has fun. Now I can give you some guidance toward making your ham club meetings fun, but I want you to try 'em. Afterwards get the members to critique the meeting so you can learn what works and what doesn't work—and perhaps even why. Next, write a letter to *73* telling me what you've discovered—what did and what didn't work. I'll get this into *73* so other clubs can learn from your experience. Together we can build ham clubs which will give amateur radio the strength we need to cope with anything.

As you get to thinking in terms of providing fun, you'll begin to notice that very few members give good marks to business meetings. They just aren't fun. We've managed to lose thousands of ham clubs down through the years, victims of long, boring business meetings. Clubs should, as much as possible, have ail club business taken care of by an executive committee. If a member gripes, have him come to the next executive committee meeting—that'll shut him up.

Business meetings are pernicious in that members tend to get deeply involved with them when they're happening, so the club officers may not realize the deadliness of what's happening. The pattern has been repeated over and over—meetings where mem-

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QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

LETTERS

BUBBLE GUM FUN?

Hear! Hear!

NJ8F, writing in the March issue, hit home dead center! With the average age of hams at 46, I wonder what the average age of a *73* subscriber might be? A few years older, I imagine! I join Staff Stafford in his comment/complaint that the type size was too small for many of your gray-power customers.

I would like to offer a comment/complaint of my own. With the average age of a ham at 46 (I am somewhat older) the "Fun!" feature by KI2U hits far short of the mark. It is written, in my opinion, for a much younger, bubble-gum-chewing audience. The space could be used better for presenting some of Wayne's "finger in the dike" ideas for saving ham radio from itself.

All in good cheer!

Mick McDaniel W6FGE
San Diego CA

We went back to 8-point type (from the too-small 6) in the March issue. (Articles are in 9-point type.) As far as "Fun!" is concerned, over 18% of our readers "read it regularly," and more than a thousand responded to the 1985 KI2U poll (see June issue). No bubble gum was found adhering to any of the responses.—KW1O.

PACKET SOAPBOX

I was a little amazed at the letter on packet radio by Mr. Payne (*73*, December, 1985). I must agree with his indignation at the statements indicating that packet radio will replace other forms of RTTY. It is simply an additional mode, although "packet" has been in use by the military for years. It is with the remainder of his letter that I must take umbrage.

I don't know what magazines Mr. Payne reads or what dealers he talks to, but for some time packet node controllers have been available for less than $200. One manufacturer even has a computer-interface model that does CW/RTTY/AMTOR/ASCII *and* packet. As for the baud rate, most ASCII TTY is 110 to 300 baud. (By the way—nothing is "error-free" if conditions are minimal.)

As concerns satellite communications, a simple set of converters at a 15-W output level will put you on the air for less than $200, not counting antennas (build them yourself). As concerns antennas for satellites, admittedly some have large dishes, but the largest I personally know of is 12 feet. Small yagi arrays (11–22 elements) are much more common. Mr. Payne's example of 12 over 12 (mine is 11 x 11, purchased used for $35) yields an estimated 13-dB gain for approximately 200 erp for a 10-W input—the output of most small rigs and converters without needing an amplifier.

Perhaps before making such disparaging statements, Mr. Payne should do some research on his subject first. He might enjoy the hobby more.

Now that I'm off my soapbox, thanks for a great magazine.

Dean Milner VE1CBF
Sydney, Nova Scotia

My first satellite QSO (through RS-7) was made with an Ameco 2m rig, bought at a hamfest for $20, feeding a 5/8-wave magmount attached to a metal ashtray and propped up on the roof. I just used my dipole for the 10m downlink. Has anyone done it cheaper?—KW1O.

SHORT, SWEET, 'N' SOUR

Joined local radio club as SWL after a mall demo. Took two years for club to decide to have Novice class. During class we had 4 out of 9 students drop out. When I asked older club members to give these people help, the answer was, "Let them do it the hard way like I did." After becoming a Novice and getting on air, no advice, help, inspiration, or whatever was put forth, and if I hadn't gotten POed I would have quit. "Army psychology." By constant prodding of my "peers" Novice instructor stayed after club meeting to help us to upgrade. Eleven months from Novice I made General and other 4 made Tech. Now 2 years later; only one other made General. There have been two Novice classes, as I got students and bugged instructor and with offer to help we had classes. I got candidates for classes in supermarket (baggers), donut shop, and by asking fellows if they would like to be hams and explaining. Two classes started with 15 each and ended with 7 and 2, primarily because instructor was boring and taught *Tune In The World*, your basic Pass-A-Test-But-Learn-And-Understand-Nothing. I wanted to start by first making code oscillator and learning the what, why, and how of components. Of course it would take more time, but it's worth it to create hams instead of machine operators—real hams. Some of our last Novice candidates came from the *73*-inspired "Ham-Day," March 24, 1985, where 4 in club of 50 invited in others. I asked everyone: people in local Post Office, man who gave me lift when I ran out of gas, official at election place, and a couple of Boy Scouts. Made contact with hams on Antigua and Newfoundland so they would help out. Got 4 Novices out of it. Been looking for Ham-Day info for 1986 but have been disappointed and this is what prompted all this. *Why no Ham-Day?*

Last Friday at 6th-Grade Science Fair I demo'd hamming. Asked kids from 4th, 5th, and 6th grades their first names and showed them how in CW. After an average of 3 times they could do it pretty well, so I told them to come back in 10 minutes or so and see if they still could do it. Long story short—got nine young Novice candidates out of four hours. Fun. That's how hard code is.

I criticized QSL Bureau and was told how much work. . . . I know a General-class op that can't tune his rig if somebody moves controls around. Know one who went from Novice to Extra in 3 months but can't fix his keyer or even try. Takes tests well, though. What I think is wrong with ham radio is the older hams—most of them are not doing their job! They need inspiration or kick in pants.

Walter G. Bastow N4KVF
Gold Hill NC

OK, there's one vote for another Ham-Day. Any others?—Ed.

HE WHO LAUGHS LAST

Welcome back, Wayne! The magazine has missed and needed you. Hope you are able to bring it back to the old rabble-rousing, controversial, yet interesting ham monthly it once was.

Please consider bringing back some features now gone but that I enjoyed in the past—namely, Pasternack's "Looking West," and "Circuits."

I used to laugh at your editorials when you stated that the masses would be using computers soon. Not me, said I. So here I am, using a Commodore 64 and a Speedscript word processor. OK. You were right at least once!

Frank L. Gore K6RTZ
Sierra Madre CA

Look for our old friend WA6ITF in next month's 73.*—Ed.*

DEAR WAYNE:

Thank God—you're back!

Ben Alabastro WA2PXR
Frankfort NY

WELCOME BACK!

Byron Kretzman W2JTP
Huntington NY

Welcome back! To me, *73 is* Wayne Green. I was sorry to see you leave and am glad to see you back. I won't stop my subscription now!

George Lesch WB2ENP
Staten Island NY

Nice to have you back!

Walter Taylor K2MLT
Hammondsport NY

Thank heaven you are back! Now I'll keep my subscription to *73*.

Merv Simpson WA6YSD
Santa Rosa CA

When you left *73*, so did I—now that you're back, so am I. Wayne, how about giving us the *73* we used to have?

Hal Beebe N6IWI
San Leandro CA

Just watch!—Wayne.

TOOTH & NAIL

Your info about the 40 hams who support K6ADA is totally wrong (*73*, December, 1985, page 7). First off, there aren't 40 hams in the area, and the hams who are in the area will fight tooth

Continued on page 108

NEW PRODUCTS

FOX TANGO NEWSLETTER INDEX

Fox Tango Corporation now offers a comprehensive cumulative index to the *FT Newsletter* covering 1976–1985. Articles are grouped by model number (FT-101, FT-757, and so on), and called out by year and page, topic, title, and author.

Both the index ($4 ppd. in the U.S. and Canada, $5 elsewhere) and individual volumes are available from *Fox Tango Corporation, Box 15944, West Palm Beach FL 33411; (305)-683-9587.* Reader service number 154.

SAMS ACQUIRES BOOK LINE

Howard W. Sams, Inc., has acquired the Basic Electricity series of books from Texas Instruments. The series consists of three hardbound books, two lab manuals, and an audio course. The three books are *Basic Electricity and Dc Circuits* ($14.95), *Basic Ac Circuits* ($19.95), and *Basic Electronics Technology* ($19.95). The two lab manuals, *Practical Applications of Dc Theory* and *Practical Applications of Ac Theory*, are available for $12 each.

For more information about these and other Sams books, contact *Howard W. Sams and Company, 4300 West 62nd Street, Indianapolis IN 46268; (800)-428-SAMS.* Reader service number 156.

REGENCY MX-5500 SCANNER

Regency Electronics has announced a 25–550-MHz continuous-coverage scanner. The MX-5500 covers all standard VHF and UHF bands, including four amateur bands (6, 2, 1-1/4, and 3/4 meters). The scanner is preprogrammed at the factory with 20 popular frequencies and is capable of searching through a band for active frequencies.

Designed for home or mobile use, the MX-5500 comes with a telescoping whip antenna, an ac power supply, a dc power cord, and a mobile mounting bracket.

For complete details, contact *Regency Electronics, Inc., 7707 Records Street, Indianapolis IN 46226.* Reader service number 155.

DX HOW-TO FROM TAB BOOKS

DX Power: Effective Techniques for Radio Amateurs is a new book co-published by the American Radio Relay League and Tab Books. Author Eugene Tilton K5RSG gives advice and how-to tips on all facets of DX and DXing, including how to bluff successfully, how to work the DXCC list systematically, and how to stalk rare DX. Tilton explains the special techniques used on the various amateur bands and details leapfrogging, tailending, random calling, and other methods to increase your DXCC total.

For more information, contact *TAB Books, Inc., Blue Ridge Summit PA 17214; (717)-794-2191.* Reader service number 159.



The Regency MX-5500 25–550 MHz scanner.

ICOM ANNOUNCES IC-751A

ICOM has announced a newly designed update of their IC-751. The IC-751A is a 100-Watt HF transceiver with a .1–30-MHz general-coverage receiver. Features include all-mode, 100% duty cycle operation, 12-volt power supply, an electronic keyer, a 500-Hz CW filter, QSK up to 40 wpm, an LED annunciator, and improved noise blanking.

For more information, contact *ICOM America, Inc., PO Box C-90029, Bellevue WA 98009-9029.*

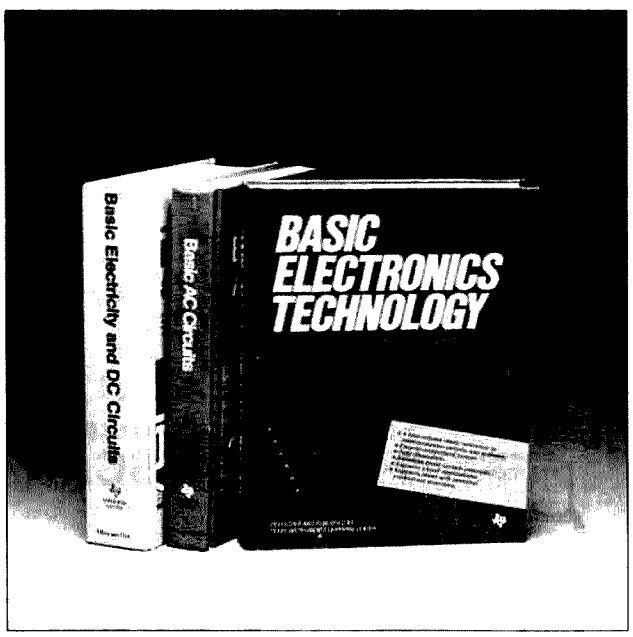
APA PACKET SWITCH

Amateur Packet Alaska has announced the APA VHF/HF Switch, a device which allows any TNC-1 or TNC-2 packet system to be instantly switched from VHF/1200-baud to HF/300-baud operation without retuning or recalibrating. The switch can be activated either manually or by external logic. The switch is housed within the TNC cabinet and takes about an hour to build and install.

The APA VHF/HF Switch is available for $30, and a 15-page nomograph describing VHF/HF switch designs is $3. Please note that APA is an all-volunteer organization and is not equipped to receive telephone or credit card orders. Contact *Amateur Packet Alaska, AX.25 Communications Trail, Ester AK 99725.* Reader service number 160.

WINNER'S EDGE SOFTWARE

Winner's Edge Software has released a new contester's system for the Commodore 64 and 128. Contester II maintains multiplier checklists, dupe sheets, logs, running score, multiplier tallies, and other statistics. The program



Electronics courseware now available from Sams.

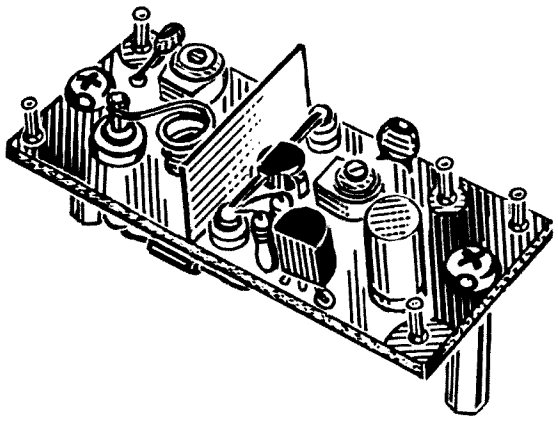


ICOM's new IC-751A HF transceiver.

sends CW, including preprogrammed and user-supplied contest exchanges.

Separate modules expand the basic program's functions to cover specific contests; the ARRL DX Contest module is now available, and modules for the ARRL Sweepstakes and the *CQ* Worldwide DX Contest will be available later this year.

The Contester II requires a Commodore 64 or 128 and one disk drive. A printer is optional. The program is available for $39.95 postpaid from *Winner's Edge Software, 2003 Sarazen Place, Reston VA 22091; (703)-620-3776.* Reader service number 161.



Hamtronics' LNW preamp.



Metz offers stainless-stees antenna systems.

HAMTRONICS ADDS LOW-BAND PREAMPS

Hamtronics has added low-band units to their popular line of GaAsFET preamps. Typical gain is 22 to 28 dB with a typical noise figure of .8 dB. The preamps are small enough (1.6" x 0.6") that they may be installed inside most radios; connections are made by soldering subminiature coax directly to terminal pins on the preamp PC board. Models available are: LNW-28 (25–35 MHz), LNW-50 (35–55 MHz), LNW-75 (55–90 MHz), LNW-100 (90–120 MHz), LNW-144 (120–150 MHz), LNW-160 (150–200 MHz), LNW-220 (200–270 MHz), and LNW-432 (400–500 MHz). Each preamp is $19 in kit form or $34 assembled.

A 40-page catalog describing these and other Hamtronics products is available for $1 (overseas send $2) from *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535; (716)-392-9430.*

METZ STAINLESS-STEEL ANTENNAS

Metz Communication Corporation now offers a complete line of VHF and UHF stainless-steel antennas, hardware, and low-loss RG-8/X coaxial cable. Stainless-steel coils designed for each amateur band from 10 meters to 450 MHz can handle 250 Watts of rf. Each coil is pretested, identified with a serial number, and coded for the band of operation. The antennas mate with SO-239 connectors; magnetic, through-glass, and other mounts are also available from Metz.

For comlete details, contact *Metz Communication Corporation, Corner of Routes 11 and 11C, Laconia NH 03246.* Reader service number 157.

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2500 2M H.T.	179.95
2600 H.T./Sub Tone	239.95
MFJ	
484 Memory Keyer	$ 99.95
732 Filter	45.00
410 Prof. Morse Keyer/Trainer	79.95
SWAN	
Cubic Astro 103, Xcvr w/CW Filter	$429.85
PSU6-P.S./Spkr.	99.95
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570-Century 21	199.95
263-VFO-Corsair	154.95
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FT980/Gen. Cov. Xmt.	$1,175.00
SP980 Spkr/Audio Filt	45.00
FT980 Am Filter, Gen. Cov. Xmt	1,195.00
FT980, Keyer	1,175.00
FT107M/DMS/FP107E P.S.	569.00
FT101ZD CW, Fan	549.95
FT101ZD AM Warc Bands	549.95
FT101Z, Remote VFO	105.00
FT101E, CW	449.95
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Head-to-head: Uniden's Bearcat 800XLT versus Regency's MX-7000

by Marc Stern N1BLH

Regency Electronics, Inc.
7707 Records Street
Indianapolis IN 46226
MX-7000: $699.95

Uniden-Bearcat
6345 Castleway Ct.
Indianapolis IN 46250
800XLT: $499.95



The Uniden-Bearcat 800XLT.

When you first look at the Regency MX-7000 and the Uniden-Bearcat 800XLT side by side, an automotive analogy comes to mind. The MX-7000 seems like a rocket-fast Ferrari, while the 800XLT is like a Chevy—basic transportation. Looks as if it's a case of old technology up against the latest in microcomputer-based systems.

Even the boxes give this impression: The Bearcat looks like Bearcats have always looked, while the Regency has a sleek, modern shape with a sloping front, an LCD and a tiny box.

But look again—rather than simply being a case of old versus new, it's more a question of why change for the sake of change? The 800XLT uses the same style of box that has served Uniden-Bearcat for years. It's a practical design that was outlined more than 10 years ago when the first programmable Bearcats appeared and that has been refined ever since. On the whole, it's a much more comfortable design to use.

For example, the 800XLT keyboard angles out from the display area in a way that makes the scanner easy to program. Likewise, the gas fluorescent display is easy to read from about 10 feet away. This visibility has as much to do with the type of display and its brightness as with its viewing angle, which is good.



The Regency MX-7000.

The MX-7000's LCD is visible in most lighting conditions because of the angle of the display, but there are times when ambient light can overwhelm it and cause it to wash out. The display light offers little help because it's too small and doesn't illuminate the display area brightly enough.

Awkward Entry

The MX-7000 is loaded with high-tech goodies and capabilities, but you are forced to handle many of the functions yourself—entering bandwidth, for instance—while in the 800XLT much of the work has been handled in software. For example, if you choose to scan frequencies from 118–136 (the aeronautical service band), the 800XLT automatically selects AM rather than FM. With the MX-7000, you must physically select AM and enter it along with the frequency choice and the memory channel choice, which is rather inconvenient.

In fact, the method of memory entry in the MX-7000 is not only awkward, it's dangerous—it's possible to unintentionally overwrite existing memory information. For example, when you're writing memory information to the MX-7000's scratch pad, you must not only enter the type of modulation technique—narrowband or wideband, FM or AM—but also the bandwidth of the signals you'll be monitoring and the frequency. When this is done, the flag "CH" blinks at you on the LCD as the MX-7000 asks you to store the information in one of its 20 memory locations. So far, this seems pretty straightforward, and it is, but unless you are quick on the membrane keyboard, by the time you're ready to enter this information, you may well have forgotten the channel in which you are storing the information, and you may easily overwrite an existing entry.

This type of mistake is also possible with the 800XLT, but it's a lot less likely to occur because fewer steps are needed to program in a frequency. Again taking the aero band as an example, to program in a frequency you simply manually advance the memory display to an unused channel and enter the frequency followed by the enter key. Since the choice of bandwidth and modulation is handled by the 800XLT's software, it's automatically set up for AM with the correct bandwidth.

Of course, using software to handle these functions does rely on the programmer's microcode assumptions about the appropriateness of a given mode for a given frequency and doesn't take into account regional or local variation. However, by and large, this method works for most of the frequencies in most of the nation.

A unique feature of the MX-7000 is its bandwidth selection. Although it complicates the setup and programming, it gives you the ability to keep distortion to a minimum because of bandwidth problems. For example, if you are listening to an area of the spectrum that uses 5 kHz narrowband FM, you can program the scanner for 5 kHz reception. It offers 12.5 and 25 kHz bandwidth, too. This ensures clean reception of a particular frequency. On some scanners that use fixed bandwidth, it's possible for a conversation to sound distorted because of bandwidth problems. The proper bandwidth also helps ensure a minimum of crosstalk from other frequencies, and it helps the MX-7000 retain its selectivity.

Coverage

The more ambitious of the two scanners in this face-off is the MX-7000. Like the 800XLT, the MX-7000 is microprocessor-controlled and it is capable of covering 25 to 512 MHz continuously, as well as 800 MHz to 1.1 GHz. This contrasts with the 800XLT, which offers coverage in 12 bands from 29 MHz to 912 MHz. Specifically, the 800XLT covers 29.6 to 29.995 MHz; 30 to 50 MHz; 50 to 54 MHz; 118 to 135.975 MHz; 136 to 144 MHz; 144 to 148 MHz; 148 to 174 MHz; 406 to 420 MHz; 420 to 450 MHz; 450 to 470 MHz; 470 to 512 MHz, and 806 to 912 MHz.

You should note that both scanner manufacturers have finally realized that their units are being used by people other than public service radio monitoring enthusiasts. For amateurs, both scanners will cover the FM portion of 10 meters and the entire 6-meter band. Regency, in fact, has broadened the coverage to include frequencies down to 25 MHz so that its scanner can be used by any radio hobbyist.

As recently as five years ago scanner manufacturers assumed the only frequencies anyone was interested in monitoring were the public service band and the marine band. Now, they realize that their units are routinely used by amateurs to monitor favorite repeater or FM frequencies, as well as by other radio hobbyists. I suspect that much of this has to do with the expanded capability of integrated-circuit-based radio receiving technology. But, whatever its basis, it's a welcomed change.

Specifications

	Uniden-Bearcat 800XLT	Regency MX-7000
Size:	10-5/8 by 3-1/2 by 8	5.4 by 3.1 by 7.9 (inches)
Weight:	5 pounds	2.4 pounds
Power:	117 V ac, 20W, 12 V dc, 9W	13.8 V dc
Battery:	Standard 3-volt (alkaline recommended)	
Receive Sensitivity:	0.3 uV 29–54 & 136–174 0.8 uV 118–136, 60 percent, 1 kHz modulation, 12 dB Sinad 0.5 uV 406–512 0.7 uV 806–912 (±3 kHz deviation 12 dB Sinad)	Narrow FM: 1.0 uV (12 dB Sinad) Wide FM: 1.5 uV (12 dB Sinad) AM: 1.5 uV (10 dB S/N)
Receive Selectivity:		NFM ±7.5 kHz at 6 dB WFM ±50 kHz at 6 dB AM ±5 kHz at 6 dB
I-F Selectivity:	-55 dB at ±25 kHz	-50 dB
Frequency coverage:	29–30 MHz 30–50 50–54 118–135.975 136–144 144–148 148–174 406–420 420–450 450–470 470–512 806–912	26–28 MHz 28–50 50–54 54–88 88–108 108–136 136–144 144–148 148–174 174–216 216–220 220–225 225–336 336–406 406–420 420–450 450–470 470–512 800–1.2 GHz
Channel capacity:	40	20
Audio output:	2 Watts, 10 percent THD	1W at 10 percent THD

Scanning and Searching

Continuing the comparison, both the 800XLT and MX-7000 will scan and search, but the MX-7000 offers even more. It will display the time, retain memory without a battery, and allow you to adjust its receive bandwidth. Both units have a priority scan.

In the memory channel department, the 800XLT comes out the winner with 40-channel capability. The MX-7000 offers 20-channel capability. In its start-up mode, the 800XLT scans the first 20 memories. A second bank of 20 is accessed from the 800XLT's keypad.

Programming

It's easy to see that the MX-7000 is for the serious user. Programming it is far more complicated than you would expect, although it doesn't take long to get used to doing it.

To program a memory channel you must first determine the reception mode (narrowband FM, wideband FM, AM). After you've determined this, you press the manual keypad; then press the NFM (WFM or AM) key and enter. You then punch in the frequency and press enter.

At this point you may think you're done, but you're not. Instead, all you've done is programmed the scratch pad memory. You must now put it into permanent storage in dynamic RAM. To do this, you must press "CH" for channel and enter the particular channel you want and then press enter. As you can see, it takes three key sequences to program a channel, which is far from user-friendly.

On the 800XLT, however, you simply determine the frequency you would like to enter, hit the manual key, advance to the memory you want to store it in, enter the frequency, and then hit enter. It takes only one simple key sequence to accomplish this chore.

Memories

Like the MX-7000, the 800XLT uses dynamic RAM memory. Memory retention is another story—the manufacturers have diametrically opposed positions. Regency, manufacturer of the MX-7000, takes advantage of capacitor-backed memory retention. The MX-7000 uses a high-value bleeder resistor to enable the capacitor to retain as much of its charge for as long as possible. This discharge takes about a week, so memories are retained without the need for battery backup.

Uniden-Bearcat uses a more traditional battery backup for its RAM. But rather than using rechargeable NiCds and circuitry to keep them charged, the 800XLT relies on alkaline cells that have higher voltage but that are only good for a few hours to about a day or so because of the voltage requirements of the memory. Uniden should think of implementing some form of long memory storage in this unit.

Keypads and Beeps

It is also quite apparent when you look at the keypad that the 800XLT is far more user-oriented. It uses real push-buttons, rather than the plastic membrane overlay of the MX-7000. The use of push-buttons gives the 800XLT a far more positive feel and makes it easier to enter frequency information.

The MX-7000's membrane keypad is harder to use because it lacks a substantial feel. If

you don't hit a key in the right spot, you won't get the response you expect, a problem endemic to all membrane keyboards. A beep does sound when an entry is made correctly, but it seems that Regency could have used a keypad with real keys to implement programming. Hand-held manufacturers use real pads on their units, which have smaller areas than the MX-7000 has available.

The Rear Deck

On the whole, the rear of the MX-7000 is far busier than the rear of the 800XLT. On the rear of the 800XLT are connectors for 13.8 V dc, ac, ground, antennas, and memory backup batteries. If you look closely at the rear of the 800XLT, you also become aware of something different. Not only is there a connection for an external VHF/UHF antenna, but there is also a connector for an 800-MHz antenna. Unlike the MX-7000, which uses the standard whip antenna or an external antenna for 800 MHz, the 800XLT uses a separate, fixed 800-MHz antenna, which works surprisingly well.

The MX-7000 has an interesting feature that the 800XLT lacks, an attenuator switch on the rear. Switching it on cranks in 10 dB of signal attenuation to prevent receiver overload. It's a nice touch, especially if you're in the near field of a high-powered transmitter. And while this enables your scanner to remain operating, it does have a drawback in that you will only hear the loudest signals. Weak or distant signals won't get through. It's a good idea to use the attenuation only if absolutely necessary. The rear apron also contains the power, antenna, and external speaker connectors.

The MX-7000 is essentially a mobile unit. As such, it requires 13.8 V dc at all times. When running it off 120 V ac, a special step-down transformer is used. The transformer runs cool, and it easily meets the voltage and current requirements of the scanner. It uses a special triaxial power plug. So, if you're going to use 13.8 V dc you'll have to remember to wire a plug to work correctly.

A nice feature of the MX-7000 is its antenna connector. Rather than using a Motorola-type plug, Regency has used a low-loss BNC connector. The 800XLT uses two Motorola-type connectors.

Performance

The 800XLT turned out to be a good, all-around performer during evaluation. Because of the location of the test site—a hilltop about 335 feet above sea level with a clear shot to the horizon—I was easily able to hear stations up to 35 miles away using the telescoping antenna that came with the scanner.

The 800-MHz stub worked quite well, too, even inside a metal-framed building. The 800XLT is fairly free of birdies. As in other Uniden-Bearcat scanners I've used and evaluated, the birdies were primarily evident in the 40–50-MHz range, as well as the 150–160 range. However, they only appeared on widely scattered frequencies and were no problem.

The MX-7000 was also fairly free of birdies, although it was prone to intermod products in the presence of moderate rf, something to be aware of if you're planning to use it in your shack. The 800XLT was also somewhat prone to intermod.

Specifications

The 800XLT has some good specifications and its performance rivaled them. For example, its sensitivity is 0.3 microvolts from 29 to 54 and 136 to 174 MHz. From 118 to 136—the AM aircraft band—it is 0.8 microvolts at 1-kHz modulation for 12 dB Sinad. From 406 to 512 MHz it has a sensitivity of 0.5 microvolts and from 806 to 912 MHz it has 0.7-microvolt sensitivity with 3-kHz deviation at 12 dB Sinad. Intermediate frequency selectivity is -55 dB at ± 25 kHz.

The MX-7000's specifications were also more than reasonable. For starters, it scans continuously from 25 to 512 MHz and from 800 MHz to 1.2 GHz. It was also one of the first scanners on the market to cover the microwave region of the radio spectrum.

Receive sensitivity is 1.0 uV for 12 dB Sinad on the narrowband FM setting and 1.5 uV for 12 dB Sinad on the wideband FM setting. On AM, the sensitivity is 1.5 uV for a 10 dB S/N.

Receive selectivity is 7.5 kHz at the 6 dB point for NFM; 50 kHz at 6 dB for WFM, and 5 kHz at 6 dB for AM.

Image and spurious rejection is better than -50 dB, while intermodulation rejection is better than 50 dB.

Both scanners are equally capable in the audio department, delivering about 1 to 2 Watts of audio with little or no distortion. This is more than enough for any environment.

As you can see, both sets of specifications are very good, although the 800XLT is hotter than the MX-7000, as the figures show.

Both instruction manuals were clear and concise. They were clearly written and will easily lead anyone through the setup and use of each scanner.

Money Matters

The most serious consideration to be made here, though, is the list price of the MX-7000. At nearly $700, frankly it's too expensive for the casual listener, especially when you consider the $499.95 suggested list of the 800XLT. It is hard to justify spending $699.95 for a receiver when that's nearly the price of a good, mobile HF transceiver that offers more capability for the money. It's also hard to justify that amount of money when others also offer comparable units for less money. However, the final choice is still up to the buyer, and if you're determined to have an MX-7000, you should be able to shop around and find discounts in the vicinity of $250. Still, that's a steep price to pay for a complicated unit.

Reader service numbers: Regency MX-7000: 150, Uniden-Bearcat 800XLT: 151.

Heathkit Dual-Trace Oscilloscope

by Paul M. Danzer

Heath Company
Dept. 011-402
Benton Harbor MI 49022
IO-4225 oscilloscope:
$499

The first thing I noticed when I picked up my new Heathkit oscilloscope kit was that it weighed about 30 pounds, including about 10 pounds of carton and shipping material. Quite a contrast to the 75 or so pounds of my soon-to-be retired Tektronix 545.

Make no mistake about it. For a catalog price of $499 (and no surcharge at the Heath retail store) the model IO-4225 is a fully professional instrument meeting the specifications shown in the box—when properly aligned.

My first clue to the complexity of the kit was uncovered as soon as I opened the carton. In addition to the inevitable set of correction sheets to the manuals, there was an additional piece of paper which turned out to be a directory for the shipping carton. This very handy little slip of paper told me where to find the various paper bags of components. The fact that a directory was needed should give you the clue as to how many parts there are.

Construction

Heath sorted out most small components into four packages—numbers 1, 2, 3, and a "final" package. I used two 12 x 16 aluminum-foil baking dishes, with the components of the "final" pack in one dish and one numbered package in the other dish.

Most of the small components come sorted out in order, mounted between two pieces of paper tape. For the initial part of constructing each of the three major boards, each component in turn is taken off the paper tape and inserted in the board. Those who remember assembling early kits will be happy to note that most of the resistors and capacitors are disposed of in this way, leaving few to be identified by hand (and eye). This is fortunate since on the tiny resistors the color code seems to change color when painted upon a brown-body resistor.

Heath sections each board, and construction (or "parts stuffing") proceeds generally from the left section of the board to the right, thus making life a little easier on you. But don't forget: This is not a kit for shaking hands. I found a clear head, a good light, and a magnifying glass (thoughtfully supplied by Heath) absolute necessities. Tiny connector pins designed for automatic machine insertion turn out to be a problem when approached with a pair of hands and long-nose pliers.

I found only one error in the assembly man-

ual. Most embarrassingly for someone at Heath, the error occurs on a correction sheet. An old error is corrected but a new error is made—the instruction step to install R520 is missed.

As you would expect from Heath, all of the holes are drilled in the right places and all of the screws fit, but when you try to wire the horizontal section front panel onto the horizontal circuit board, you probably will find your fingers don't fit.

Test and Alignment

Frankly, I was disappointed in the test and alignment section. The old ohmmeter procedure, carried over from the vacuum-tube kit days, is probably OK if Heath would specify clearly where the positive and negative ohmmeter leads (or the ohmmeter lead with positive voltage on it or the lead with negative voltage on it) go for each measurement. Using an ohmmeter to test wires with semiconductors attached, where the ohmmeter sees the semiconductor junctions, turned out to be a rather hit-and-miss procedure.

The greatest disappointment, however, was with the alignment procedure. Nowhere in the catalog did Heath say you would need precision timebase and voltage-calibration equipment, and those of us used to the old Heathkits which contained built-in test sources are in for a rude shock.

In a telephone conversation with a Heath technician, I was told that there were a few complaints about it but they felt people would use common sense and that the customer would realize that high-quality test equipment would be needed to align a high-quality scope. I guess I am guilty; my common sense, based on prior kits, apparently failed me.

Actually, with a 1-kHz square-wave generator, a variable rf and audio generator, and a good counter a pretty fair alignment can be carried out. The process has to be carried out several times in a row. I found, not to my surprise, that the vertical channels are in fact wideband, high-gain amplifiers which before alignment verge on instability, producing very high-frequency sine waves on the trace seen on the screen. After alignment, all signs of instability seem to disappear.

Circuit Description

As you can see from the block diagram (Fig. 1), a dual-channel wideband amplifier provides a choice of either channel 1, channel 2, or chopped (both). A rather complex attenuator section feeding several gain stages provides an input capability ranging from millivolts to volts.

The horizontal channel provides a choice of a standard sweep ("A" timebase) or a delayed sweep ("B" timebase). The operation of the "B" timebase is outlined in Fig. 2. When you set the "A" timebase, the ramp voltage which provides the linear "A" sweep is compared against a dc voltage set by the time-delay-position control on the front panel.

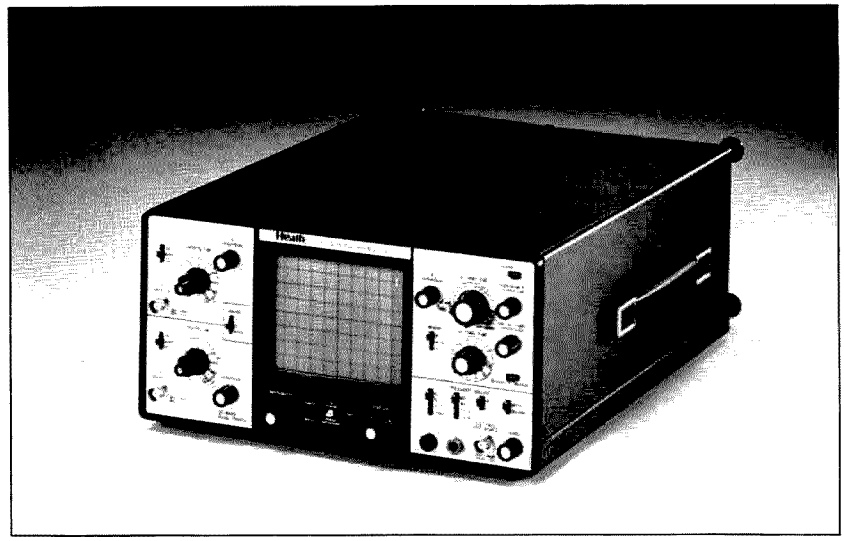
When these two voltages are instantaneously equal, the circuit says "OK, now I'll start the 'B' sweep." If the sweep-mode control is in the "A x B" position, the length of the "B" sweep intensifies the baseline of the "A" sweep so that you know where you are and what will be shown when you change the sweep mode to "B Delay." When you do change to the "B Delay" position, the "B" sweep is now used, and it starts where you previously set it with the delay control.

Sweep trigger can be selected from an external source or either vertical. Although I have not tried it, it appears that since the sweep selection is independent of the channel selected for display, you can display one channel and use the second as a high-gain sweep-trigger amplifier—a very handy trick indeed.

A few other goodies are provided including a standard TV-sync separator for use in TV troubleshooting, a component tester, and a probe-calibrate voltage for setting probe risetime.

Manuals

As usual, Heath provides a full set of manuals for construction and operation. The manuals are new, have a few bugs, and some strange things are done. As an example, the



The Heathkit 25-MHz dual-trace oscilloscope.

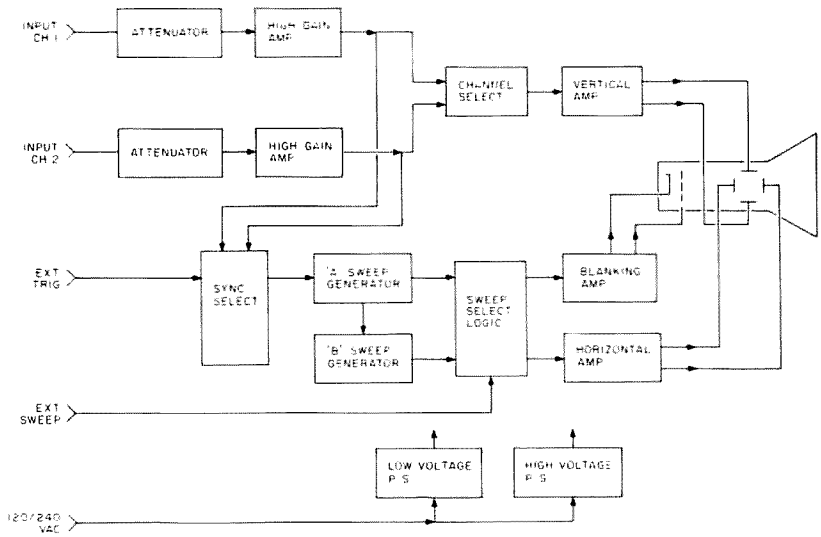


Fig. 1. Block diagram.

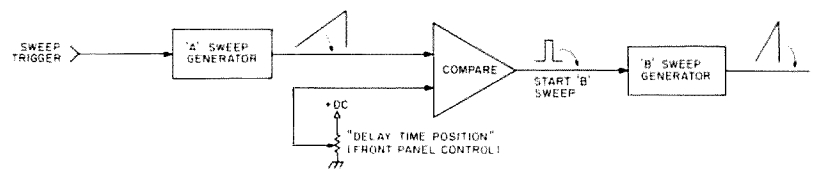


Fig. 2. Delay-sweep generation.

pictorials showing the controls for alignment are not labeled as to which board is which pictorial, a problem you can rectify with a few strokes of a pen. Other errors did not seem to affect anything since the step-by-step assembly instructions are correct (except for the missing resistor mentioned before).

The circuit-description section of the manual is written clearly, but be prepared to deal with such terms as "cascode amplifiers" and "bootstrap" circuits.

Good and Bad

Unquestionably, for about 500 bucks you get a quality instrument; is this kit for you? As far as I could test, using an old Tektronix and a newer Tektronix clone as a reference, the kit lives up to the published standards. Construction is not easy, and good vision, nimble fingers, and at least average color discrimination are needed.

Circuit design seems quite clean and straightforward except for a few cute tricks, such as in the attenuators of the vertical channels. I was surprised how few dual devices and integrated circuits were used—most of the design uses discrete transistors and FETs.

After alignment and realignment, stability appeared acceptable, and the little things such as lack of jumping from range to range as you switched vertical scales seemed to be taken care of. The horizontal trigger system worked as advertised, and was a great improvement over my old Tektronix.

Specifications

Vertical
Dual channel
5 mV/cm to 10 V/cm
3% to 5% accuracy
Dc to 25 MHz
16 nS rise time
1 megohm + 32 pF input
400 V max input (peak)

Sweep Trigger
Select:
- Either vertical channel
- External
- Ac line

Modes:
- Ac
- Dc
- TV vertical
- TV horizontal

Horizontal
Modes:
- A sweep
- B sweep
- X—Y
- External

100 mS to 0.1 microsec/cm
3% to 5% accuracy
5X magnifier
External sweep:
- 0.1 V/cm
- 1 megohm + 40 pF

Other
8 cm x 10 cm CRT
20 lbs
6" (H) x 12" (W) x 20" (D)
120 V ac or 240 V ac

If you get the Heathkit IO-4225, plan to spend from $60 to $140 dollars more than the cost shown in the catalog. A minimal scope calibrator, needed for alignment and calibration, costs about $60. Without alignment and calibration, you might as well stick to an old uncalibrated scope. Good probes also are needed if you want to take advantage of the scope rise time and use it for looking at those digital circuits on the bench. Without the probes ($30 to $40 each) you will waste your money on this scope.

My own evaluation: Since I plan to keep this instrument for a long time, the ability to service it myself and get repair parts without canvassing all of the Japanese parts distributors by long distance phone is important. As compared to brand name alternative scopes (and only brand name units), the Heath machine will cost you a few bucks less—or you get a few more features for about the same money. The "fun factor" in building it yourself? Given the size of the kit and its complexity and parts density, this one is either more fun than usual or a bit too much—it's up to you to decide.

Reader service number 152.

DSE Commander VHF FM Transceiver

by Peter H. Putman KT2B

Dick Smith Electronics
390 Convention Way
Redwood City CA 94063
Price class: $150

Got the old kit-building itch? Yearn for the smell of solder? Burnt rosin on your fingertips? Or the many hours spent squinting through a magnifying glass looking for solder bridges? Think of it: when was the last time you built a kit that was really fun?

I don't remember either, but I did have a great time assembling the Dick Smith Electronics Commander VHF FM transceiver—it's a good way to spend a few hours (well, 10 or more). When you're all done, you'll have a 10-Watt synthesized FM rig with full 4-MHz coverage. No memories, no scanner, no bells and whistles, just a plain old two-meter FM rig along the lines of the old ICOM IC-22/22S/22U. With a few qualifications, it works well and is easy to tune up.

Assembly

The write-up of the Commander appeared in the August and September 1985 issues of 73, so I won't elaborate here on its technical specs and performance claims. What I would like to do is address the process of building the kit and aligning it afterwards, as well as a few minor problems and one major problem I found with the unit.

As the kit came from DSE, all of the parts were neatly sorted into various bags. A quick check against the parts list revealed one too many resistors and one too few capacitors—items that were in my well-stocked junkbox. I found individual parts overlays helpful in identifying parts placement, although an all-inclusive parts placements overlay, like the one that appeared in 73, would have been useful. Of course, Dick Smith gives you an "out" in the form of a notice that tells you to return the kit unopened for a full refund if you don't think you can pull it off.

I assembled the kit over the course of four nights: I tackled all the resistors (150 or so) on night #1, the capacitors (175) on night #2, the inductors and transistors on night #3, and the balance of parts and cabinet on night #4—a total of about 10 hours, or 2-1/2 hours per night. This made for a nice work pace. One minor problem I encountered, which I talked to DSE about, is the substitution of capacitors, where physically smaller ceramic capacitors have been substituted for larger disc capacitors. This is all well and good, except when the drilled holes for the larger capacitor won't accommodate the smaller one. Some of these low-voltage ceramics actually break in half when stretched too far, so I do consider this a drawback. Either extra holes need to be drilled, or the correct capacitors must be supplied.

Another problem arose momentarily when it came time to install the front and rear panels with respect to the PC board. The panels actually have to be installed upside down—that is, when holding the unit so that the front panel reads correctly right side up, the bottom of the PC board faces up. This is mentioned nowhere in the literature, but the few minutes I spent studying the placement of the thumbwheel switch with relation to the speaker solved the problem. The front and rear panels are made of single-sided PC-board material, which is easily tack-soldered to the main board for extra strength (not to mention the ground contact for both panels!).

Alignment

Despite these problems, I plowed onward and soon had the front panel completely wired up. You must be careful when making the connections to the thumbwheel switch not to bend the wire too much, as DSE supplies telephone wire for these connections. This type of wire is a bit stiff and really doesn't lend itself well to this type of use. A better choice would have been ribbon cable, preferably multi-col-

ored. This flexible cable sustains bending a lot better. I suggest you use wire ties to group the various clusters of wire whenever possible, especially the power leads and volume/squelch control leads from the front panel.

Make sure you solder the ground return from the speaker output jack to the back plane. Don't depend on the barrel of the jack to make contact, as the hole it goes through isn't plated. I missed this and spent 15 minutes wondering why there was no audio output from the speaker! I also substituted a standard Amphenol SO-239 jack for the one supplied. The Amphenol didn't protrude as far over the circuit board as the supplied jack and made a shorter connection to the rf OUT/ANT connection possible.

Finally, I had the unit completely assembled. After applying power, I immediately heard a strong local repeater on 146.985 MHz and used it for the balance of the alignment. DSE says you will need a multi-meter, frequency counter, or 2m FM rig, a dummy load (or 50-Ohm antenna if you can't find one) and a 5-MHz oscilloscope or shortwave receiver. Frankly, all you really need is the multi-meter (preferably a FETVOM or VTVM) and counter.

The alignment procedure is easy. The built-in S-meter allows peaking the front end in short order. The other coils that align the vco, offset oscillators, and PLL are quite broad. The counter expedites the reference frequency calibration, and you could almost align the +5 kHz switch by ear. This part of the procedure went quickly. The problems arose when I tried to align the transmitter, which exhibited wild fluctuations in output power that I couldn't tame. The problem turned out to be the vco buffer amplifier, and a quick fix by DSE returned the unit in fine working order.

Few Complaints

In actual use, the receiver is quite sensitive. DSE claims the selectivity to be better than 60 dB ± 25 kHz, which actually is pretty broad. Most commercially made FM rigs exhibit better selectivity figures, and whether this will be a problem for you depends on the density of 2m repeaters in your area, as well as channel spacing.

Where I live in northern New Jersey, I'm in close proximity to about 75 different repeaters. The standard here is 15 kHz channel spacing, and it's enough of a problem even with fairly tight receivers! So I wasn't at all surprised to see signals from 146.79 sneaking in at 146.805, or 147.000 leaking through at 146.985. But the receiver is sensitive indeed, which also aggravates the problem of selectivity. I understand from the manual that 25 kHz repeater spacing is standard in Australia, where this kit originated. It might be advisable to make a tighter filter option available for the United States, especially for those who live near large cities.

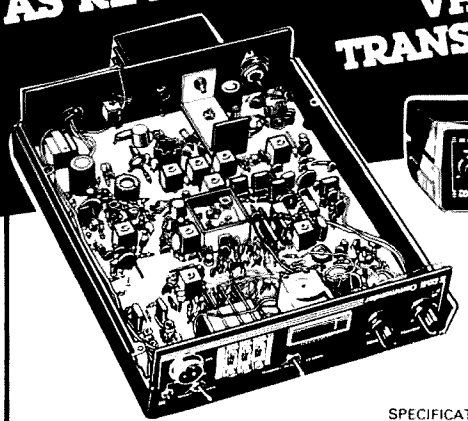
As far as the transmitter goes, I received nice audio reports (some stations mentioned a tinny quality to the audio, indicating excessive high-frequency response). One model made by DSE involves increasing the size of the microphone input coupling capacitor to 10 uF from 1 uF to increase low-frequency response. The only adjustment on the microphone audio stage is for deviation and not microphone gain. I prefer both in FM transceivers, since the gain can very well be too high but the deviation can also be too low!

Other reports included excessive leakthrough of hash noise and alternator whine. The DSE Commander does employ a filter network consisting of a choke and capacitor, but it may need to be larger. I don't receive the same reports when using my Kenwood TR-7400. Using windshield wipers and the heater fan also created noise on the transmitted signal. These problems, however, are easily rectified (no pun intended).

This brings me to my major complaint: The audio output is very low for mobile operation, especially in a high-noise environment. The audio stage is rated at 500 mW output (so is the 8-Ohm speaker) and I usually had the audio gain all the way up, at which point I could copy signals most of the time, but that introduced a lot of distortion into the audio product. DSE needs to run at least 2 to 3 Watts output from the audio stage to overcome the absorption of carpeting and upholstery, as well as general ambient noise. I sort of solved the problem with an outboard 3-Watt power module stuffed into the cabinet.

Other than that complaint, this is a fun kit to build, and a useful rig around the house and car. Now, if they could just tighten up the receiver and boost the audio output...

AS REVIEWED THIS ISSUE!
VHF TRANSCEIVER



SEE AUG-SEPT 1985 For Construction Articles



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Frequency: 144-148MHz in 10KHz steps (5KHz offset)
Mode of operation: FM
Suppy req: 12.8V DC 2.5A (15W output)
Receiver: Dual conversion Superheterodyne
Sensitivity: 0.5uV for 12dB quieting
Selectivity: Better than 60dB at plus/minus 25KHz

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Lousy Inconsiderate Dummies

Recognize anyone?

It's my observation that any time two or more hams gather together, their conversation soon turns to the Lousy Inconsiderate Dummies (LIDs) who are ruining ham radio. The subject is not unknown to come up during QSOs, too. So, in my never-ending efforts to be helpful, I'd like your help in trying to identify the areas of expertise into which these lids fall.

Lids most certainly are a major problem for many of us, but before we can tackle the lid problem we have to identify and isolate it so we don't find ourselves diluting our problem-solving efforts by getting off on tangents.

Now, how should we go about classifying lids? Being of an engineering turn of mind, I tend to gravitate toward starting with Lid 01 and working up from there methodically. Perhaps I'm being optimistic—maybe I should start with Lid 001, since it's possible we might go over 99 types of lids! In some ways amateur radio seems to offer limitless possibilities—this may be one of them. I'll stick with Lid 01 for starters, and try not to be too testy if, with your expert lid-identifying help, we're able to describe over a hundred types of lids.

Lid 01. This is the rotten, lousy, dog-mothered SOB who jams nets by insisting on his witless rag-chewing on an Official Net Channel. For instance, the South East Asia Net (Seanet) is an incredible cornucopia of rare DX which can sometimes be faintly heard mornings on the high end of 20m. Two or three Chicago super-lids insist on using what must be at least ten kW to talk a half mile across town with each other every damned morning on the Seanet channel.

Lid 02. This is the ridiculous DX fanatic who suddenly wants you and your buddies, who have been talking on this channel every morning for several years now, to either shut up or move so he can annoy the hell out of a bunch of Asians who have a net on the same frequency and who probably don't want to be bothered by someone from the United States breaking in to get a DX contact anyway.

Lid 03. The unmitigated turkey who suddenly appears on your frequency calling some buddy of his on schedule, making a mess of your contact.

Lid 04. The stupid clod who is talking on your sked channel when your sked time comes up—despite your efforts to get him to move somewhere else in the band so you can hear your buddy—or even to shut up for a couple damned minutes so you and your sked can make contact and find a clearer channel.

Lid 05. The jerk who spends his time kerchunking the repeater, timing it out and making it useless for everone else.

Lid 06. The officious repeater user who insists on call letters being used because "it's the rules and regulations, fella"—despite the fact that everyone talking to each other recognizes who's talking at any time. This chap is quick to point out even the slightest infraction of the rules as he interprets them, often driving repeater users into a frenzy of impotent rage.

Lid 07. This is the senile ham who never, ever allows even one lousy microsecond between transmissions on the repeater. This chap is usually in contact with another 07, complete with an outrageous signal which can't be broken. These old boys can keep a repeater tied up, saying nothing whatever of interest, for hours on end.

Lid 08. This is the repeater mavin who sets his repeater so it times out in 30 seconds, thus assuring that his repeater will never be used for anything of any significant interest. This also makes certain that the repeater will continually frustrate virtually every user, driving the more loosely-coupled ham minds to thoughts of retribution.

Lid 09. This is a subset of 08, the repeater op who sets his timeout at one minute, thus making sure to aggravate almost anyone dumb enough to try and use his repeater for anything beyond kerchunking. His enjoyment is in having it there, taking up a valuable 2m channel, and being able to hear the soul-satisfying kerchunk when he pulls his HT from under his pillow in the middle of the night. Lid 09, when out of bed, is never seen without his HT on his belt. It is never tuned to any other channel than his repeater.

Lid 10. Say, we're getting into this, aren't we? This is the Novice who calls CQ endlessly using Morse code (reputedly used by the fathers of our hobby and memorialized by forcing Novices, who don't know any better, to use it). Morse code was abbreviated as MC in the early days. In an unfortunate accident, the type for a page in an old issue of *QST* was dropped on the HQ floor and the letters were put back upside down. The HQ staffers, being bureaucrats and thus not overly bright, refused to admit their mistake, saddling us forever after with the term CW for Morse code. I thought you might like to know where CW came from. Why the endless CQs? Simple: The Novice, being only able to send and unable to receive, having gotten his license via a good friend, wants to have the fun of transmitting, but doesn't want to be made to look stupid by not being able to copy any responses. The answer is to just send CQ and never listen at all.

Lid 11. This is the Novice who sits and listens to an endless CQ and then tries to call the

CQer, apparently being too dense to realize that the CQer has no intention whatever of responding to a call.

Lid 12. This is the chap who acknowledges, one by one, everything you've said in your transmission and then turns it back to you. Okay on the QTH there...okay on your rig...okay on your antenna...okay on your handle...back to you.

Lid 13. The idiot who makes a second transmission to Lid 12, other than to sign off.

Lid 14. The OSCAR user who dumps a kilowatt into the satellite, thereby overloading it and making it so no one else can use it.

Lid 15. The OSCAR user who complains because I've gone to the trouble to have a good solid signal into the satellite so I can be heard.

Lid 16. The DX fanatic who can't wait for a DX station to sign off with his present contact and insists on tail-ending with his call at every break in the contact.

Lid 17. The operator in a rare DX spot who goes back to tail-enders.

Lid 18. The DX nut who hears a pileup and jumps right in on top just to prove he can dominate the frequency with his rock crusher and twelve-element wide-spaced beam.

Lid 19. The cretin who is too dumb or too lazy to put a decent signal on the air who complains when you make your daily contact with your good old buddy on Lord Howe Island.

Lid 20. The traffic-handling dummy who can't even count the words in his messages right for the check.

Lid 21. The nit-picking net manager who fusses over an insignificant error in the check number—on a message obviously of no consequence whatever which probably will never get delivered anyway.

Lid 22. The inconsiderate lumpen who gets into a sideband rag-chew in the slow-scan part of the band.

Lid 23. The slow-scanner who plops his big signal down on your QSO and sends 15 steady minutes of chirping, wiping out your contact.

Lid 24. The high-speed CW op who's using a Morse-code computer and doesn't even know the code.

Lid 25. The low-IQ jealous CW op who is too dense to set up a computer to copy the code and who tries to make life miserable for the smarter ops who've figured out how to beat the Morse-code problem.

Lid 26. The disgusting old fart who insists on using four letter words on the air.

Lid 27. The old-timer who argues that since even the FCC hasn't been able to define what words can't be aired, why should some asshole object if he uses salty language now and then to express himself? If he doesn't like it he can damned well tune off.

Lid 28. The slow-scanner who sends endless *Playboy* and *Penthouse* centerfold pictures, filling the slow-scan part of the band, which is narrow enough as it is, with junk.

Lid 29. The slow-scanner who complains about someone sending beautiful pictures over the air—something a lot more interesting to watch than the hundredth dumb picture of a shack or a ham's ugly wife and kids.

Lid 30. The chap who calls you because he needs a QSL with your prefix, or from your state, your county, your zip code, or some other such impersonal reason. Why should you waste your time and postage on some jerk who has decided he is going to make WAS in 24 hours on 75m phone?

Lid 31. The ham who promises you a QSL for your Ten Band WAS and then doesn't send it.

Lid 32. The DX operator—usually in a very rare country—who refuses to respond to your QSL.

Lid 33. The DX op who sends his QSL to a rare country op or his QSL manager with the wrong date and/or the wrong time, making it a bitch to check the log. No IRC enclosed, of course. Doesn't this chap realize how much postage costs these days?

Lid 34. The first-time DXpedition operator who operates outside the American phone band and asks for calls between 14.100 and 14.200.

Lid 35. The DXer who jumps up and down between 14.100 and 14.200 calling the DXpedition on random frequencies, thus ruining contacts in progress in that band. Lid 35a is the slightly smarter DXer who listens with a second receiver or with one of those newfangled digital receivers to the DXpedition channel and also tunes the 14.100 to 14.200 band to hear where the DXpedition is listening—then jumps on top of the frequency and never mind who is already there.

Lid 36. This is the DXpedition or operator in a very rare country who is working an endless list provided by some cohort.

Lid 37. The DXer who gets nasty because he isn't on the list.

Lid 38. The mobile dingle who is driving to or from work and talking via the mountaintop repeater to a fellow dingle a half mile away. Much of the conversation has to do with expert criticism of observed poor driving practices in his vicinity, a subject of obvious deep interest to the dozens of chaps waiting to use the repeater.

Lid 39. The high-powered 2m op with a big beam who sits all day tying up the local repeater.

Lid 40. The mountain-topping frustrated DXer who ties up a half dozen repeaters on a channel trying to make a contact through just one of the repeaters.

Lid 41. The repeater user with absolutely nothing whatever to say who won't wait for a mountain-topping DXer to make a contact through a distant repeater, but instead uses a local repeater and makes the DX contact impossible.

Lid 42. The flying repeater user. This chap can tie up even more repeaters than the mountain-top DXer. His big complaint is the length of some of the squelch tails on some repeaters on the channel he's picked.

Lid 43. This is the dope who is eagerly trying to get through to the flying lid, tying up his local repeater and making so much hash on the channel the flying lid is unable to really hear anything.

Lid 44. The packet-radio op on the lower bands whose rig keeps endlessly repeating a message because his rig doesn't get perfect copy due to QSB, QRM, or QRN.

Lid 45. The CW op who gets frustrated by a packet-radio station and gets even by jamming it—resulting in the packet rig endlessly (and mindlessly) repeating the message.

Lid 46. The DXpedition operator who asks for donations to help defray the cost of the trip.

Lid 47. The DX operator who is too chintzy to help out with the incredible costs involved with putting on a DXpedition and who could easily afford to send along at least a tenner. If he's on the Honor Roll he's a cheapskate if he sends less than $100.

Lid 48. The DXpeditioner who operates from somewhere else than where he says he is, figuring what difference does it really make? After all, DXers can make contacts anywhere in the world and where you are is no less difficult for most of 'em to work than if you were where you said you are. I believe this approach was pioneered by WØMLY in his infamous operation in North Africa. Every contact counted for ARRL credit, so what the heck, right? I've gotten a whole bunch of QSLs for DX contacts where the operator wasn't really there—and they all count.

Lid 49. The DXer who pauses for one instant before making a DX contact just because the operator may not be where he says he is.

Lid 50. The unconscionable, fatherless chap who uses a rare DX call with reduced power just to have the fun of being on the power end of a pileup for a while. No, not one of the thousands practicing this deceit has ever been punished for this, but the freedom from fear of being caught should not encourage this outrage on innocent, trusting DXers.

Lid 51. The DXer who refuses to work a rare station because he suspects it may be phony. True DXers may complain, but they observe the fixed rule: Work 'em first and bitch later.

Lid 52. The ego-driven maniac who decimates a pileup to work a very rare station and then, after the contact, jams the channel to keep anyone else from working the rare one.

Lid 53. The Honor Roll DXer who gets a new one and then doesn't do everything in his power to keep his competitors from keeping up with him. Ruses include jamming the DX, asking the DX to move to 80m for a try, asking all sorts of questions which will keep the DX op busy answering until propagation has changed, and so on.

Lid 54. Contest operators who leave open numbers here and there in their contest logs to be filled in with mythical contacts (with missed countries, sections, or whatever) so a log cross-check won't give them away.

Lid 55. The contest op who doesn't use every known stratagem to win the contest. After all, his competitors are going to. If this means claiming 90 Watts out when more like 5,000 was used, who's to really know?

Lid 56. The ham club president who does all he can to keep young hams from messing up his club.

Lid 57. The youngster who comes to a ham club meeting made up entirely of old-timers—which is about what there is to choose from these days—and shuffles his feet when bored.

Lid 58. The ham who brags that he doesn't have any QSL cards when you ask him for one to confirm your contact with his state, section, zip code, county, or area code.

Lid 59. The ham who sends out a QSL for every contact he makes, creating guilt feelings with type-58 lids who don't have any QSL cards and are too damned rotten chintzy cheap to buy any.

Lid 60. A QSL fanatic who gets every QSL he can and indexes 'em in a big filing cabinet so he can pull yours out every time you contact him and make you feel guilty for not having his at hand.

Lid 61. The information fiend who makes a note of everything you mention during a contact and then, the next time you work him, even if it is years later, has total recall of the last contact.

Lid 62. The obviously brain-damaged operator who has no recollection whatever of his contact with you last week—or last month. The SOB doesn't even remember your name.

Lid 63. The op who has to be reminded every other transmission of your handle—or who never gets your call right twice in a row.

Lid 64. The nitpicker who is so organized that he writes down your name and call and thus never has to be reminded of them during a contact—proof positive of little imagination or creativity.

Lid 65. This is the cliché-er who will see you further down the log because he has to pull the big switch and modulate the mattress.

Lid 66. The ham who puts up with a cliché-user without screaming at him, suggesting he go back to CB where he belongs.

Lid 67. The ham who cheated to get his license and refuses to ever discuss anything technical so he won't give away his total ignorance of electronic technology and radio.

Lid 68. The frustrated pseudo-engineer who, at the slightest provocation (or with none at all), plunges into a deep technical treatise on something you have no interest in whatever. Any ham with some technical smarts will recognize immediately that this lid is full of partly-understood theory.

Lid 69. This is the chap in a round table where there are some YL ops who thinks it's cute to make constant double-entendre remarks, thus making the YLs and everyone else uncomfortable.

Lid 70. The YL with no sense of humor, who objects to being called OM and gets huffy at sexist remarks.

Lid 71. The self-important ham who quickly brings up his Jaguar, his twin-engine plane, his yacht, and other boring things.

Lid 72. The world-traveler who calls rare DX stations and sets up dinner meetings with them.

Lid 73. The ham magazine editor who, with obvious false modesty, doesn't mention Who He Is, thus making his contact feel like a real jerk when he finally figures it out—often after signing and hearing another station calling frantically to work said "famous person."

Lid 74. The ham who is so totally unread he doesn't know who the editors of the four ham magazines are so he'll recognize one when he hears him. This chap probably wouldn't even recognize Barry Goldwater if he worked him.

Lid 75. Any ham who tries to solve his own TVI problems without the help of fellow hams as intermediaries.

Lid 76. Any ham who refuses to help another ham with his TVI problems.

Lid 77. Any ham crazy enough to lend a fellow ham his rig while he's on vacation. The rig will never again be the same. There is only one case in all ham recorded history of a rig being returned in better condition than it was when borrowed and that ham is now living in Borneo (V85AA).

Lid 78. Any ham who borrows a rig from a ham going on vacation and expects the lender to ever again be on speaking terms after noticing the big scratch your junior op put on the front panel. (That's the scratch even the black magic marker couldn't hide.)

Lid 79. Actually this is a group effort—hams who turn up in a skiing village with their HTs and take over the local repeater for a few days, leaving the locals—the chaps who paid to put it up and keep it working—substantially irritated.

Lid 80. Local ops who fuss because a few visitors use their precious repeater for a couple of days.

Lid 81. The QRP fanatic who wants you to move over or shut up so he can make a tenth-Watt contact somewhere he shouldn't—often with some rare DX op who should better spend his time working stronger signals.

Lid 82. Mobile ops who add to the QRM by trying to work DX beyond their depth.

Lid 83. The 20m rag-chewer who steps all over QRP and mobile ops who are trying to do the impossible so they can get a lousy mention in *QST* for them to make into a plaque and hang on the shack wall.

Lid 84. The 3999er who insists his signal is not outside the band.

Lid 85. The 80m CW op who makes it a point to walk all over DX phone stations who operate in his CW band.

Lid 86. The 75m DXer who believes it is his right to work DX phone stations operating in the CW part of the band.

Lid 87. The Italian operator who spellsa everythinga for youa twice-ah.

Lid 88. Guess who.

Lid 89. Any YL ham who bridles at me writing "guess who" for Lid 88.

Lid 90. The 75m AMer who is obnoxious about being so far behind the current ham technology.

Lid 91. The 75m SSBer who makes it a personal vendetta to harass the 90s.

I'll leave a few for your suggestions. I suspect I haven't even really begun to tackle the lid problem we face as yet—so let's get the list over 100 and see where it goes. Once we get the list in shape, perhaps I should print it in poster form so you can hang it on your shack wall along with all your dumb certificates and other trivia to which you've dedicated your life—the stuff your kids will have to throw out, along with all those old worthless ham magazines, when you get your last mention in *QST*. ■

Lids, LOTMs, and ATLHR

Be assured that if you make an outstanding name for yourself in any one of the lid categories you could live in infamy well beyond your one-line Silent Key obit. Several hams have made my All-Time Lid Honor Roll—W2BIB, W2HH, W2OY, W0MLY, W1BUD, W2KR, and so on. What was Don Miller's call? Oh yes, W9NTP. I'll bet you have some nominations for the ATLHR.

If you have a favorite you think should be nominated for the Lid Of The Month (LOTM), send me his call and documentation to back up your nomination. I'll increase my libel insurance and we'll see what we can do to clean up this awful mess. We amateurs are supposed to be self-policing, aren't we?

No, I don't want to see vigilantes going out and lynching miscreant lids, no matter how soul-satisfying it would be. I remember when a bunch of Brooklyn hams got fed up with a local lid who would work only Spanish-speaking stations and who was very rude about this to his neighbors. A committee was formed to explain how the W2s felt. It was a large committee—not in numbers, but in weight—and it established the needed rapport. When he healed, the chap had a much better perspective on his new friends and was very nice on the air after that.

Y'all write, y'hear?...Wayne.

Donald Olszewski WA8IZV
32828 Beacon Lane
Fraser MI 48026

Speed-Charge Your PB-21

This ac/dc charger gets your TH-21AT off your belt and on the air.

Here's a way to increase the usefulness of your Kenwood TH-21AT by quick-charging the battery pack. Most people like the small size of the HT but complain about the limited battery life. The way to keep things running smoothly is to get two batteries and use one while quick-charging the other.

I don't think that Kenwood offers a quick-charger for the PB-21, and the five-to-six-hour wait for the standard 110-volt charger isn't acceptable for sustained operations such as public service events. If you're not near a 110-volt source, the problem is further compounded.

The solution is to build a charger which accepts both 110-volt ac and 12-volt dc. This permits you to charge the battery from your vehicle's cigarette lighter. The nominal voltage of the HT battery is 7.2 V, and 12 volts will charge it quite readily.

Charge Rates for NiCds

As a bit of a side note, I'd like to describe the charge rates that can be applied to nickel cadmium batteries. Most of them can be fast-charged at their milliamp/hour rating for an hour, or slow-charged at one-tenth their milliamp/hour rating for 10 hours. For example, a 180 milliamp/hour battery can be charged at 180 mA for one hour (180 x 1 = 180), or 18 mA for ten hours (18 x 10 = 180). Fast-charging shouldn't continue for more than an hour because the cells will overheat and possibly be damaged by excessive gassing. The slow-charge rate can be maintained indefinitely with no cell damage.

This charger was designed to provide both a quick- and a slow-charge rate, but doesn't switch between the two automatically. Some vigilance is required from the operator in order to avoid cell damage. It's assumed that users will be involved in extended periods of operation and will be rotating batteries. Therefore, you should stay nearby to tend to the charger and extra pack.

Circuit Details

Fig. 1. reveals the plan. The output of the rectifier is the point where 12 volts dc is applied from some external source. This potential is assumed to be the 12 volts from your vehicle's electrical system, although it can be any other dc source. Be sure to fuse this input for safety.

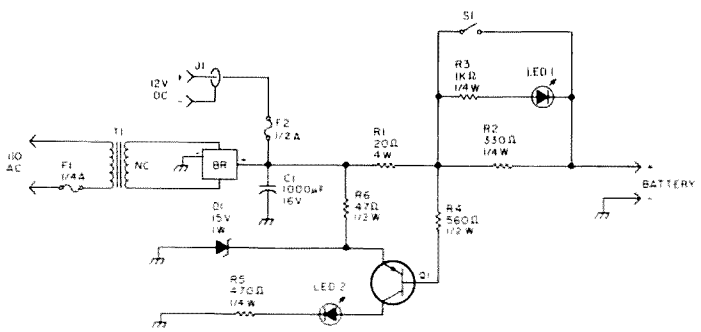


Fig. 1. Schematic of quick- and slow-rate charger for Kenwood PB-21 battery pack. This circuit can be used for just about any handie-talkie battery pack. Change the values of R1, R2, and F2 for the charging current needed.

The unit uses a 12-volt power transformer, bridge rectifier, and filter to provide the charging potential from 110 volts. This is relatively straightforward, but you should note that the transformer center tap isn't connected. The entire secondary voltage is applied to the rectifier. Regulation and ripple in the dc output aren't a concern because the potential is used to charge a battery and not power an amplifier. We have no intention of listening to a signal. No power switch is provided since no current will flow unless a battery is under charge. The battery is, in effect, the on/off switch. However, don't forget to fuse the primary of the transformer.

R1 limits the quick-charge rate to approximately 180 milliamps, which is the rating of the battery. R2 sets the slow-charge rate at 20 milliamps. LED 1 indicates low-charge-rate current flow and R3 limits voltage across it. Switch S1 shorts out R2 and the R3-LED 1 combination, allowing the higher current necessary for quick charging; this current develops enough voltage across R1 to foward bias Q1 through R4. Q1 functions in the circuit as a switch, and is driven into conduction by the applied bias. When Q1 is on, current flows from the emitter to the collector and turns on LED 2, indicating high-charge-rate current flow. Use a blinking LED to draw attention to the fact that the battery is being quick-charged. Resistor R5 limits voltage across LED 2 and R6 helps to set the bias point of Q1. Zener diode D1 protects the transistor in case a reverse-polarity voltage is accidentally applied to the unit.

Most of the parts used are garden-variety items with no critical or unusual components. Feel free to substitute. A discarded AM/FM circuit board can provide most of the parts. If you have a well-stocked junk box, you can probably build this charger for nothing. If not, some careful shopping at the next swapfest should yield everything, with the cost limited only by your ability to bargain. If

all else fails, your friendly neighborhood Radio Shack should have all the necessary parts, except for the spring brass used for the battery contacts. Even here you may be able to use contacts from one of their battery holders. With Radio Shack as a parts supplier, the total outlay shouldn't be more than $35, according to their 1985 catalog. This price may seem high, but it assumes you have to actually purchase everything.

Beginning Construction

Begin construction by carefully cutting a slot for the Kenwood battery at one end of the project case. Mark the slot with a pencil by tracing around the battery; cut the opening slightly undersize with a keyhole saw. Then use a flat file to get it to the final size. Work slowly and don't let the opening get too big. It should hold the battery firmly in an upright position, and not allow it to rattle around or shift in the opening. This prevents loss of contact when the charger is used in a vehicle that is in motion. Remember, if there is no contact with the battery, no charging takes place.

The project case suggested has internal slots for circuit boards, and this method of mounting is used for the power supply. The transformer is the bulkiest item, but with a little care all of the items can be placed on one vertical board.

A second board is used for the battery contacts. This one is mounted horizontally on four long screws that function as posts. Put extra nuts on both the underside and the top of the board to provide a firm platform for holding the HT battery (see Fig. 2).

Now comes the only real home-brew portion of this project, and it requires some resourcefulness on the part of the builder: The charging contacts of the battery should be made from some sort of spring brass or shim stock. I fashioned mine out of a piece salvaged from a discarded doorbell switch. The brass strips were cut to match the contacts of the HT battery pack. I drilled one end of the strips to accept a mounting screw and attached them to the circuit board. Next, the strips were carefully bent into a horseshoe shape to provide the spring necessary for good contact. In use, the weight of the pack against the springs makes the required connection for the charging current. I recommend that brass hardware also be used for mounting to keep electrical resistance low.

Now construct the power-supply board. This one should slip into the slots provided inside the project case. An etched board will add that commercial touch to the project, but point-to-point wiring will work as well. Once the cover is on, no one but you will know the difference.

Because of the small number of parts and the room for liberal substitution, I haven't provided a circuit-board layout. If your junk box yields something that will work but is different in size or lead configuration than the part specified, such a layout would have little value; hence, the builder is left to determine the best component placement.

I found the following steps convenient: The

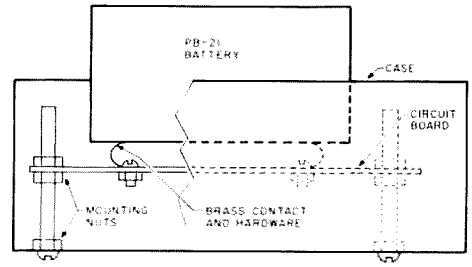


Fig. 2. End view of case and cut-away portion showing brass charging contacts and method of supporting the battery while in the charger. Drawing is not to scale.

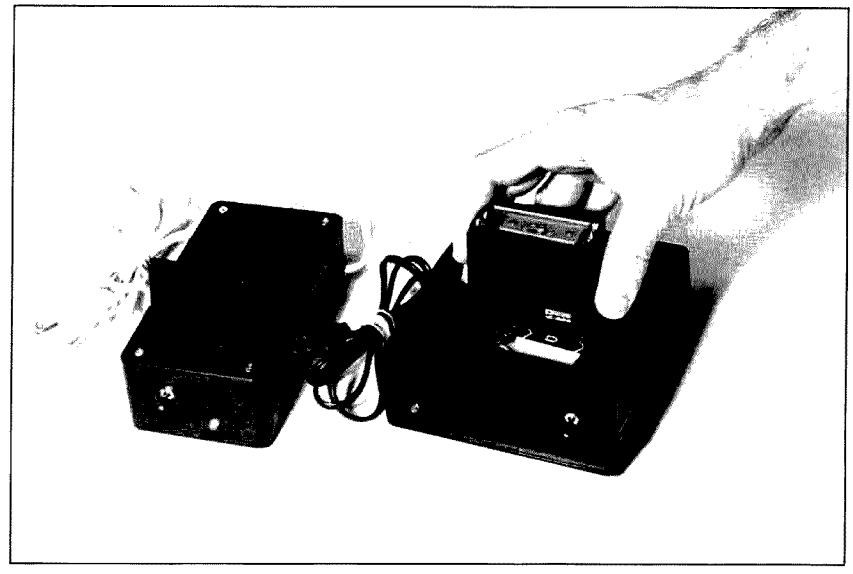


Photo A. The charger described in this article is shown on the left. The photo gives a good view of how the battery pack is held while being charged. The unit on the right uses the same circuit, but the values of R1, R2, and F2, along with the power transformer, have been changed for the higher current required by the ICOM BP-4 pack. Construction of this unit preceded the one described in the text.

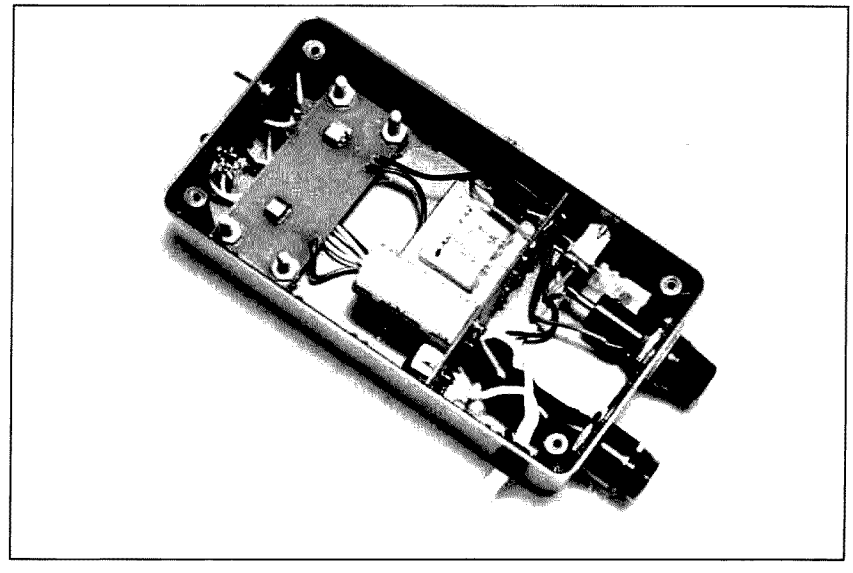


Photo B. Here, the unit is shown with the cover removed. At the left is the circuit board and charging contacts that support the battery while it is being charged. In the center is the power-supply board. At the right are the power connections. Clockwise from top they are: 12-volt dc input, 12-volt fuse, 110-volt primary fuse, and line cord.

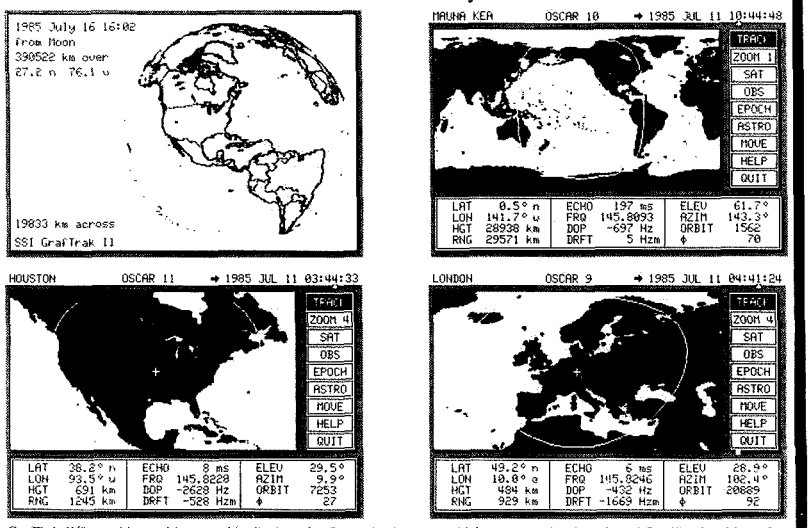
transformer should be mounted first. Put it low on the board so that it will be near the bottom of the case and the circuit board won't be top-heavy. Putting the primary connections at the bottom keeps the exposed 110 ac to a minimum—a good safety move.

Parts List

Part	RS#	Description	Price
BR	276-1146	Bridge rectifier, 4 A, 50 Piv	1.39
C1	272-958	1,000 uF, 16 Vx2	.99
D1	276-564	Zener diode, 15 V, 1 W	.89
F1	270-1270	1/4-Amp fuse	.69
F2	270-1271	1/2-Amp fuse	.69
J1	274-1549	Power connector	.99
LED1	276-022	T-1 3/4 LED (green)	.79
LED2	276-036	CQX21 blinking red LED	1.29
Q1	276-2023	General-purpose PNP silicon	.79
R1	271-080	20 Ohm, 4 W	.69
R2	271-1315	330 Ohm, 1/4 W	.39
R3	271-1321	1k Ohm, 1/4 W	.39
R4	271-020	560 Ohm, 1/2 W	.19
R5	271-1317	470 Ohm, 1/4 W	.39
R6	271-009	47 Ohm, 1/2 W	.19
S1	275-624	SPST switch	1.49
T1	273-1360	110-V primary, 12 V c-t	2.49
	270-223	Project case	2.69
	270-364	Fuse holder (2 required)	1.78
	278-1255	Line cord	.79
	278-1636	Strain relief	.69
	64-2346	Self-stick cushion	.89
	276-1576	Circuit-board kit	8.95
	64-2890	Hardware assortment	1.59
	278-1296	Hookup wire	2.19
		Total	34.30

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Next, mount the filter capacitor, since it is also somewhat bulky. The other items occupy little space and can be placed at will, but give some regard to the heat generated by the power transformer. When the circuit boards are complete, set them aside. Mark and drill the case for the fuse holders, power cord, switch, LEDs, and 12-volt-dc connector. Mount these items and proceed with the final wiring. I chose to simply glue the LEDs into the proper size hole. Allow extra length in the wiring to facilitate servicing.

When complete, check the charging current by using clip leads and an ammeter. Typical values should be 18-24 mA for the low rate and 180-200 mA for the quick rate. If all is satisfactory, put the unit into service.

Using the Charger

At this point, I'd like to include several notes on the use of this charger. As I mentioned, the battery pack should *not* be left on fast-charge for more than one hour. Doing so may damage it. Since the charger doesn't automatically reduce the charge current, some care is required. Don't forget that the battery is on fast-charge.

If the battery isn't needed at the end of one hour of fast charging, switch to the low rate. It can be on low-charge for an extended period of time without damage.

I've been using this charger for more than three months with no problems. It has been used during public service events to fast-charge from a 12-volt automobile battery. I did manage to fry one battery, but that was due to my own forgetfulness.

Kenwood says nothing about fast-charging the PB-21 battery; therefore, I don't recommend using this charger while the battery is still under warranty. The battery must be removed from the TH-21AT for charging.

This basic circuit can be adapted to just about any HT battery pack. As shown in Photo A, the forerunner to this project was a quick-rate charger for the ICOM BP-4 containing six AA cells. The only problem that developed with this version was oxidation of the brass contacts.

The objective of the charger cicuitry is to limit charging current flow at the quick-charge rate with R1 and to the low rate with R2. Some manipulation of Ohm's Law will give you values for these components.

Make sure the secondary of your power transformer can supply adequate current or it may be damaged. Some overload can be tolerated, since quick-charge current is drawn for a limited time. As I have described, S1 shorts out R2 to provide manual selection of the charge rate.

LEDs 1 and 2 are used to indicate that there is good battery contact and that there is a charging current flow. They won't light unless there is current flow. I prefer to use green or yellow for the low rate, and a flashing red for the high rate, which is better at getting the operator's attention.

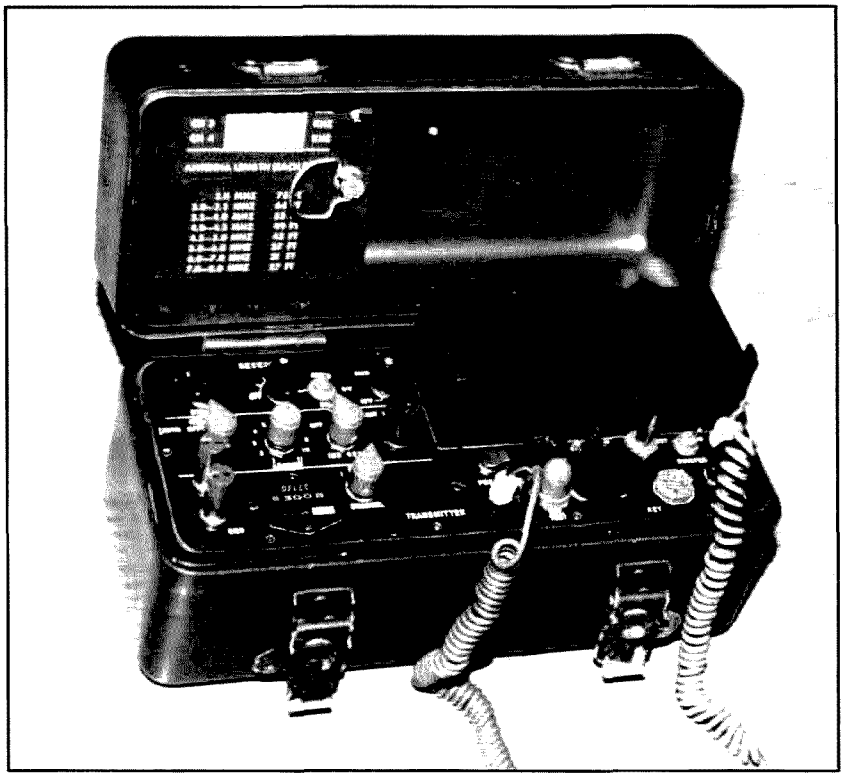
Thanks go to Don Kollmorgen K8VIG for his help and for the photos used with this article. Have fun building! ■

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Army Surplus CW

Simple conversion tips for the Special Forces PRC-64.



The Delco 5300B, the CIA version of the PRC-64 transceiver.

The PRC-64 is a small, lightweight portable transceiver used by the Special Forces which frequently turns up at flea markets. Although the manual specifies a frequency range of 2 to 6 MHz, experience with a variety of units has shown that this set easily covers the 160-, 80-, and 40-meter amateur bands with no modification.

The set is housed in a waterproof aluminum case, weighs 7½ pounds, and is capable of either AM or CW operation. The rig includes a 6-kHz ladder filter for AM and a 500-Hz Collins mechanical filter for CW. It also features a panel-mounted hand key and CW sidetone. Stated rf power output is 1½ Watts for AM and 5 Watts for CW, but these figures are based on minimum battery voltage; rf output is nearly doubled for either mode with nominal battery voltages applied to the transmitter stages.

Variants

It's good to keep in mind that you may encounter variants of the PRC-64. The Delco 5300 is the CIA version of the PRC-64, but it is electrically and physically the same. The PRC-64A includes an oscillator control circuit that prevents chirping and key clicks when transmitting CW at 300 words per minute with the GRA-7 Burst Encoder. The third variant that we've seen appears to have been produced in a very limited quantity. It can be easily identified by its lack of a bandwidth switch and its microswitch hand key. There are also at least two frequency-synthesized variations of this rig; the Delco 1600 is frequency-synthesized from 2 to 10 MHz, has a tunable receiver, and features AM modulation. The Delco 3200 is the same except that it has single-sideband modulation.

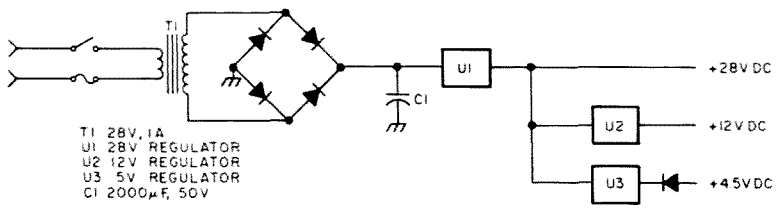


Fig. 1. Power supply.

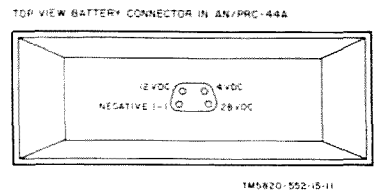


Fig. 2. Pin connections for input voltages.

Crystals

The receiver requires crystals in CR-78/U holders. The receiver crystal frequency should be the desired frequency plus 455 kHz. The transmitter requires crystals at the operating frequency in CR-89/U holders. For those of you with the Delco 5300, some, if not all, of these sets use CR-78/U holders for both the receiver and the transmitter. Check the pin spacing of the transmitter crystal sockets before ordering crystals.

You can order crystals from Sentry Manufacturing Co., Crystal Park, Chickasha OK 73018. The price is $10 each for the receiver crystals, and $13 each for crystals used in the transmitter.

Power Supply

Power for the PRC-64 was originally supplied by a BA-1509 magnesium battery, which produced 4 volts for the receiver, 12 volts for the oscillator, and 24 volts for the transmitter final stage. This battery probably isn't available now, so you'll have to construct either an ac power supply or a battery pack. The schematic for the power supply is shown in Fig. 1. Pin connections for the input voltages are shown in Fig. 2. The female plug for this connection is a Cinch-Jones number 13279. The 70-mA current requirement of the transmitter rules out the use of ordinary dry cells, so if you are contemplating portable operation, the battery pack should be built using heavy-duty NiCds.

Once you have a suitable power supply built and your crystals have arrived, you can proceed with the tune-up phase. We suggest that you double-check your connections before you accidentally hit the switch. Applying 12 or 28 volts to the 4-volt pin means instant death for the receiver.

Tune Up

To tune up the rig you'll need a 10-Watt, 50-Ohm resistor, a couple of tweaking sticks, and a 600-Ohm headset, if you aren't fortunate enough to get the original earphones. Install the receiver and transmitter crystals in their appropriate sockets. Each channel covers only a specific frequency range, as follows: channel 1, approximately 1.9–2.8 MHz; channel 2, 2.8–3.65 MHz; channel 3, 3.6–4.7 MHz; channel 4, 4.6–7.2 MHz.

To tune up the receiver, set the receive-send switch to receive, the bfo to off, the B/W switch to 6 kHz, the gain control to maximum, and the receiver channel switch to the proper channel. Connect the 50-Ohm, 10-Watt noninductive resistor between the antenna and ground terminals. Referring to Fig. 3, adjust the rf collector coil for this channel for maximum noise in the headset.

To tune up the the transmitter, set the receive-send switch to send, the loading control to 1, the AM-CW switch to CW, the IND-SENS switch to 3, and the transmitter channel switch to the proper channel.

Refer to Fig. 4 and adjust the driver coil and final amplifier coil for this channel for maximum brightness of the antenna indicator lamp while depressing the panel telegraph key. Turn the IND-SENS switch to the lowest number that will give an indication and again adjust the two coils for maximum brightness of the lamp.

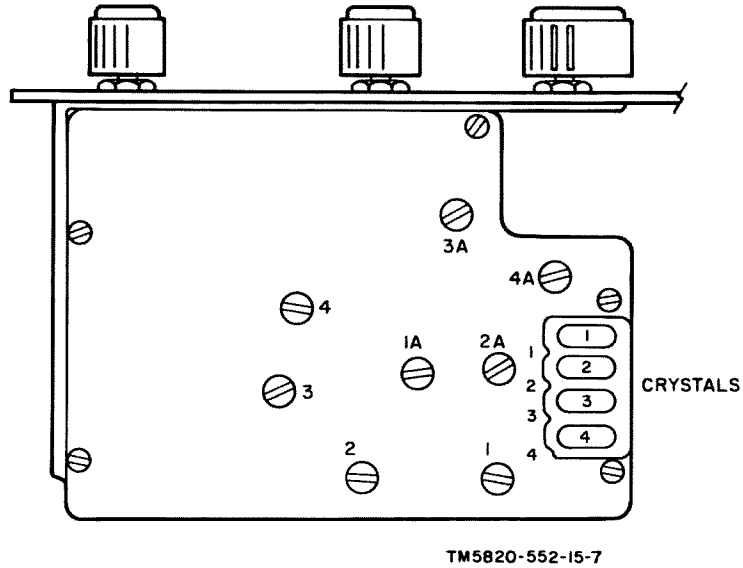


Fig. 3. Use this map to match the channel number to the appropriate rf collector coil.

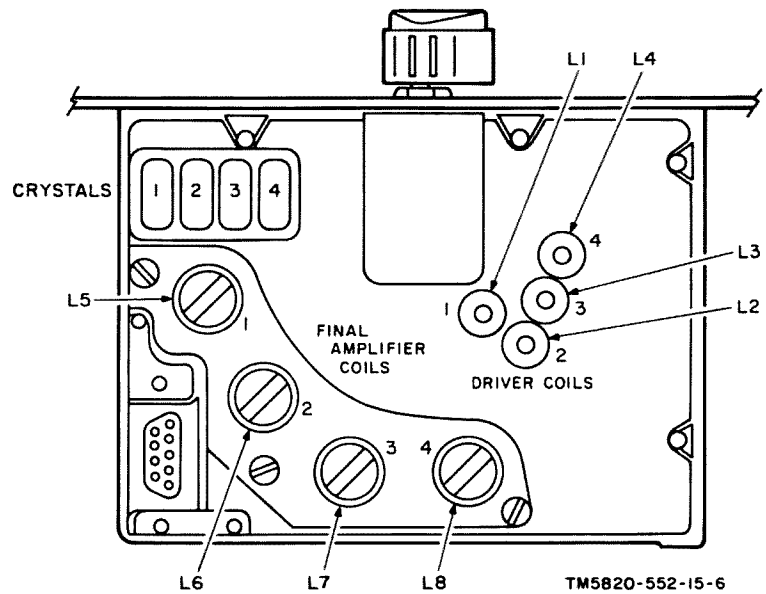


Fig. 4. Final amplifier and driver stage tuning adjustments.

Manual and Accessories

The technical manual for this rig is TM 11-5820-552-15. It is available from most dealers of surplus manuals. We also have a few copies. For AM operation, a standard dynamic microphone works well. The earphones are 600 Ohms. (The earphones from the PRR-9 rig work well.) The rig was originally furnished with a 50-Ohm dipole antenna wound on three reels, but any standard antenna from the handbook works well with this rig. For replacement transistors in the receiver, 2N207 will replace all but the audio transistors. The equivalent number of audio transistors is 2N706A.

External Key

An external key, or electronic keyer, may be used by plugging the key into the socket provided for the high-speed burst keyer. Wire the keyer to pins A and D of an Amphenol 125–195 plug. Ground is pin A.

In summary, the PRC-64 is an excellent portable or emergency QRP rig that is readily available at a reasonable price. It requires no conversion other than a tune-up and the acquisition of the crystals and accessories.

We'll answer any questions from amateurs who have either experience with this rig or questions about it. We are also interested in talking to anyone who has experience with synthesized versions. ■

C. Jim Williams W1ROM
Sokokis Trail
Limerick ME 04048

The Day the Aliens Landed in Limerick, Maine

There once was a ham in his shack . . .

As a general rule, I go to bed early (7 p.m. or so) from October to May. That way, I can get in five or six hours of sleep, awake refreshed at 1 or 2 in the morning, and get on 75-meter phone ready for the European and African DX.

My routine is to sneak out of bed so as not to disturb the XYL, feed my two Tanganyika Terriers, make a pot of tea, and settle down to pick up a country now and then, to help out on the 75-meter DXCC. Some mornings I hear little or nothing of interest, so I read or doze off in the chair. My operating position faces a window that looks out over a five-acre field where I have a pair of 40-meter verticals, a few big delta loops, and about ten cords of wood stacked up for the winter.

It's a Plane, It's a ...

One morning in early February, I was listening to a W2 working a CEØ on Easter Island. The W2 was one of the Big Guns on 75 with a 75-meter beam up 140 feet. He was giving the CEØ a 59 plus and turned it over to the CEØ, whom I copied between a 3 or 4 and signal strength the same. When the W2 signed, I called the CEØ but he came back to a W3. After four more tries, I finally snagged him and was grateful for the 34 he gave me.

There's not too much activity at 2 in the morning from W1-land, but a few W1s and W2s called the CEØ, and I half-listened while drinking a cup of tea.

All of a sudden, the band went dead—by dead, I mean nothing, absolutely no sound from the receiver. I figured the headphones had gone sour. I unplugged the phones and still heard nothing. I thought the 830S had "bought the farm" for sure. I could see myself packing it into the box and shipping it off to W6 land for repairs.

Since the window in my shack is in the back, as I looked at the receiver I noticed light, and it was getting brighter. Now, at 2 a.m. it just isn't natural to see light out in my back yard. Two steps took me to the window, where I damn near had an embolism! Looking straight out into the field and directly over the tops of the big pines that border the field, I saw a large object hovering and lighting up the entire area. As I looked, a row of lights came on and were directed downward, and a strange craft began to descend to the middle of the field.

"All of a sudden, the band went dead."

I stood frozen at the window. I realized what I was seeing could be only one thing: a flying saucer, a space ship, one of those things from outer space that the long-hair weirdos are always seeing—a UFO in my back yard!

The craft settled down and all the lights except for a few directly facing me went out. The lights that remained gave off a bluish tint, so I was able to see the entire craft without difficulty. My best guess is that it was 75 to 100 feet wide and 30 to 40 feet high above the outrigger-type legs that were supporting the craft on the ground. All I could do was stare out the window wondering what the devil to do next.

I don't remember how long I stood there, but the receiver came back to life, and I made a quick stab at turning down the audio gain. When I looked out the window again, a section of the craft was being lowered to the ground and a set of stairs telescoped from the section to the ground. My heart was pounding so fast and I was so scared that I could do nothing but watch as two figures descended the steps and stood looking directly at me. The craft and two figures were only about 200 feet from where I stood, so I could see them clearly. They appeared to be of average human height, both rather slim and dressed in black gowns that fit close at the neck. Both figures had white hair that came down their faces as far as the eyebrows—what we call "bangs" on this planet.

Suddenly, both figures bowed from the waist in my direction. When they straightened up, one of them motioned for me to come toward him.

Hams From Another Planet

I'm sure some of you would have said at this point, "Don't go out there—not on your life. Stay put; call the cops. Call the Air Force. Call up all the prayers you know, pal, because you're going to need them, fast."

I did none of those things. Instead, I left the window, put on my hat and coat, went out the back door and walked up into the field toward the two figures, who were still at the foot of their craft. As I approached, I noticed both had normal faces and skin tone; in fact, one of them reminded me of an old buddy of mine. When I got within five feet of them, one of them spoke!

"Greetings. We mean you no harm. We come in peace. My name is Douga and he is Billo." The creature pointed to the other figure.

My mouth was so dry and I was shaking so much I could barely stammer, "How do you do?"

Douga, the one who had spoken, had a little star on the collar of his black robe. I took him to be the *numero uno* creature.

"We are from the planet Prado in the galaxy of Volar, and we have been monitoring your radio signals for some time now," said Douga. "We would like to talk with you and learn many of your customs, and perhaps you will tell us what these strange objects are and what they have to do with your radio signal." While Douga was talking, he pointed towards the Rohn tower with the 6-element Telerex and at the verticals and delta loops and slopers that populated my back yard.

"You mean the antennas?" I asked, sort of pointing to them all with a sweep of my arm.

"Antennas? Is that what they are called?"

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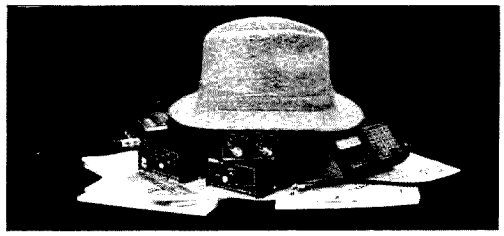
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"I guess we're just very easy to get to know..."



71

GROVE

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Billo reached down and removed a glowing object from his belt, pointed it at each of the antennas and them put it back on his belt.

"What was that for?" I asked.

"Don't be alarmed," he said, "I was only checking the radiation output. We are extremely interested in the design and size of these instruments."

Douga asked, "Would it be possible for us to look at your radio equipment? We are very interested in what you use to radiate such a strong signal. We have been monitoring your planet's signals for some time now and yours stands out as one of the strongest and most consistent."

Now I always feel pretty proud when some DX station gives me a 59, but when some creature from outer space tells me I have a big signal and wants to look over my antenna farm and rig, *that's* a compliment.

"Sure," I said, "come on into the house and I'll show you my rig." We walked towards the house, and when we got near the 100-foot Rohn with the tribander, Billo looked up at the beam, put his hand on his belt, and flew straight up in the air! He hovered around the level of the tribander and examined the elements. When I could talk, I said, "How the devil does he do that?"

"Anti-gravitational thrust," Douga replied calmly. "Do people on this planet use anti-gravitation?"

"I've never even heard of it," I told him, "but it would sure come in handy working on antennas." We reached the back door and went into the house and then into the radio shack. I don't have the best shack in the world, but I do have a TS-830, an L4B linear, an antenna coupler, a keyer, and a few pieces of 2-meter gear—not bad for an old-timer—plus a nice operating chair and a couch to grab a nap on now and then. All told, my shack is nothing to be ashamed of.

I remembered my manners. "Would you guys like a cup of tea?"

"I don't understand," said Douga.

"100 Watts into the Mark V at 14.2 MHz would radiate 1,420,000,000 Watts."

"It's a hot drink we enjoy on this planet. Would you like to try some?"

"Yes, thank you. May we examine your radiator?"

"Radiator! What's that?" I asked.

Douga pointed to the equipment.

"Sure," I said, "help yourself. I'll put water on for tea."

After I put the water on, I returned to the shack and found them both talking in a strange tongue. Billo was pointing the glowing belt-buckle at all my gear.

"Jim," said Douga in English, "how old is this equipment?"

I was taken back a little that he knew my name, since I hadn't given it to him. "How did you know my name?"

"As I said, we have been observing you for some time. Are you offended by my using it?"

"No, of course not."

"How much power do you radiate?" Billo asked.

I grew two feet taller as I gave the answer. "I can squeeze out 2 kilowatts on SSB and 1 kilowatt on CW."

"You use CW!" They looked at one another in amazement, then smiled. "Would you have the radiator path for this?" asked Douga.

"What's that? I don't understand 'radiator path.'"

"It's the electronic sequence of the equipment, or how it actually works."

I thought for a moment. "Do you mean the schematic?"

"Schematic? We do not know that term but perhaps if I could show you..." He pointed to the pencil and paper on the desk.

"Help yourself," I said.

Douga only had to draw a few lines before I knew what he wanted. He was drawing the output circuit showing a coil, capacitors, and some strange symbols I had never seen before. I opened the filing cabinet and took out the Kenwood manual for the 830, opened up

to the double-page schematic, and laid it on the table.

Billo immediately pointed his glowing buckle at it, and the two of them started chattering in that strange language again.

The tea kettle burst into song, so I headed for the kitchen while they were looking at the 830 schematic. When I returned with a tray and three cups of tea, we all sat down and I watched their faces as they tasted the tea. Both of them seemed to be delighted with the taste.

"What is this called?" Douga asked.

"It's tea. It comes from Asia. Do you know where that is?"

Both shook their heads. "Point to Asia," Billo said, indicating the Great Circle map on the wall.

I put my finger on India, and they both nodded their heads. "We know that part of your planet," Billo replied.

Douga pointed to the 830 and the L4B. "Is this the latest in your technology? What power do you run?"

"The exciter, the 830, puts out about 100 Watts, and the amplifier somewhere near 2 kW SSB." I got up the courage to ask the question that was *really* on my mind. "By the way, what are you two up to? It's not every day one gets visitors from another galaxy. Are you guys planning on taking over?"

"Oh, no" was the reply. "We are doing nothing but observing your culture and technological status and comparing them to ours."

"What have you found in regards to radio?" I asked.

"We hope you are not offended," Douga said politely, pointing to my rig. "This technology is 75 to 100 years behind ours."

"I don't understand," I said, "this is a late-model solid-state transceiver. It's the state of the art. What do you guys have that's so superior?"

Douga finished his tea, set the cup and saucer down, and looked and Billo, who nodded his head and smiled.

"Jim, your type of radio technology is based on the scientific principle that radio waves are generated in the transmitter section and then coupled into an antenna where they are radiated into space. If you remember the old theory of dropping a stone into a body of water and seeing the rings or circles spreading out from the point of entry, these rings spread outward to infinity and are supported or strengthened by additional rings caused by more stones being dropped into the water or some type of a wave generator."

"I know that theory, and it works. It's the basis for how radio signals go out from the antenna and are picked up all over the world," I replied.

"True, the old ones on our planet have recorded this type of radio technology, but that was many years ago. Have you no knowledge of ART?"

"ART? What's that?"

"It's Additive Radiation Technology, and it's the basis for our communication technology."

"Tell me more."

"Well, to put it into the simplest terms, when we radiate a radio signal with our equipment, the radiated waves, as they leave the antenna, are increased in intensity by the Herma action of the Wallo gate. In other words, as the signal is radiated into space, the speed of transmitted waves is varied so that one wave catches up with the preceding wave and makes it stronger. When all the waves reach the first wave, you have a tremendous signal going forward into space.

"This technology is 75 to 100 years behind ours."

"You must understand that the first wave generated travels at the speed of light, or 186,000 miles per second; in order for the succeeding generated waves to catch up to it, we vary the speed of the following waves up to one million miles per second so that each wave catches up with the one ahead of it and increases the master wave strength. Do you understand what I am saying?"

I really didn't know what the heck Douga was talking about but I wanted him to go on, so I said, "Oh, yes, I follow you."

He continued, "You can see that if a small amount of radio signal is generated, say on 30 MHz, you have 30 million cycles generated per second, and if every cycle adds to the strength of the first one, even by a small amount, the increase in signal strength is phenomenal. For example, let's take a generated signal of 1/1000 of a Watt at 30 MHz, okay?"

"I follow you, go on."

"If each following cycle, and there are 30 million of them, adds its 1/1000 of a Watt to the first cycles, you'll have 1/1000 x 30,000,000. In other words, a combined strength of 30,000 Watts has been added to the first cycle and that's what hits the receiving antenna. Of course, this is not possible without the action of the Wallo gate, which increases the wave speed in such a ratio that all 30,000,000 cycles catch up to the first generated wave."

"How long have you guys had this kind of equipment?" I asked.

"For at least 75 years," Billo said.

"Jim, there is something else you should know about the signal," said Douga. "Once you select a frequency, say 21.250 MHz, and start to transmit, the Hallis discriminator imposes an absorber that is attached to your frequency and destroys all other signals that come anywhere near 21.250 MHz. This means that no other signal can come within 5 kHz or it will be totally absorbed and dissipated by the action of the Hallis."

59 Plus

"Let me get this straight," I said. "Are you guys saying you have a radio that takes a 1/1000 of a Watt radio signal and boosts it up to say 30,000 Watts out in space, and then by some means prevents any other signal from coming closer than 5 kHz to it?"

Yes, that's the basic performance of our radio technology," replied Douga.

"Have you got one of those radios on that craft out there?"

"Yes, we have. Would you like to see it?" asked Billo.

"God, would I!"

Douga said something to Billo in that funny language of theirs, and Billo left the room. When he came into the shack, he had a small box about the size of a Drake TR4 in his arms. He placed the box on my operating table. I could see it had three or four dials on the front with four or five knobs and a tube-like device sticking out of the back.

"Let me show you how this works," said Douga. He reached down and snapped on a switch and a window lit up showing a digital display and readout of 9,500 GHz. Douga touched another button and the display stopped at 14.175 MHz.

"May I attach your antenna to this?" he asked.

I disconnected a PL-259 from the B/W switch and passed him the coax, the other end of which was connected to the 6-element Telerex up 110 feet in the air.

"I should mention," said Douga, "that the receiver signal goes through the same process as the transmitted signal; in other words, it is amplified—in this case, 14,175,000 times—via the reverse Wallo gate action."

"Of course," I nodded.

Douga stuck the PL-259 coax connector somewhere into the back of the box and turned on another switch. Audio came forth from the box. It took a few minutes to figure out who was talking to whom on 14.175 MHz, but whoever it was had a 5-9 plus signal and was in the clear. The guy signed. It was KH5ZZ on Palmyra signing with a W6.

"Who is he?" asked Billo.

I explained that Palmyra was an island in the Pacific and that it was a long ways off and good DX.

I pointed towards the box,"Is there any way I can use that thing to talk to that KH5?"

"Oh, yes, it's very easy. All we need to do is plug in the mike."

I passed him the D104, and he plugged it in and passed me the mike. "Go ahead, call him," he said.

"KH5ZZ, KH5ZZ, this is W1ROM, do you copy?"

"W1ROM, this is KH5ZZ. Good morning, old man, you have the strongest signal I have ever heard from the states. In fact, you have pegged my S-meter. Are you really a W1? W1ROM from KH5ZZ."

I went back and to the KH5 and assured him I was a W1 and gave him a line of talk like conditions were super between us and there was a window opened between us. I couldn't tell the guy what was really going on; he would have though I was off resonance.

"My God," I said to the two guys with me, "this is great. I would love to have this thing for a while."

Douga looked at Billo for a moment, then he said, "It's yours, Jim. You may have it for one year, and then we will return and visit you again."

"You're kidding!"

"No. It's yours. Let us show you a few more operating points." They went on to explain that the output of the 830 could be connected into the Starbeam Mark V, as they called it, and explained that whatever was put in, depending on the power and frequency, the results would be the power times the cycles per second and that reasonable caution should be exercised. They went on to say that, for example, if I put 100 Watts into the Mark V at 14.200 MHz, I would radiate 100 x 14,200,000 or 1,420,000,000 Watts on that frequency only. They cautioned that this amount of power could burn out most radio receivers.

I asked where the power cord was, and they said the radio had an internal atomic power source that would last for at least 1,000,000 operating hours.

"We ask two things in return, Jim," said Douga.

"Name them," I said.

"We want to hold a monthly meeting with you on 9,555 GHz. You can do this by dialing up the frequency like this, and you can use any antenna because the circuit in the Mark V will automatically adjust for any antenna."

They suggested the last Sunday in each month at 2315Z. If anybody out there has a receiver that goes to 9,555 GHz, you might hear us some Sunday night.

"What's the other thing?" I asked.

Douga looked a Billo and then back to me. "We would like to take some of your tea back to Prado."

"You got it." I went into the kitchen, dumped what tea was left in the jar, and took a full pound out of the closet. I put them together in one bag and went back to the shack, where I passed the bag to Douga.

"Thank you, Jim. Our visit has been a pleasure."

"The pleasure is all mine, old buddy," I replied.

"Old buddy?" said Billo. "Are you a CBer?"

"CBer? Oh, no! I want no part of that outfit."

"We listen to them now and then and have decided there is not much in their technology that would interest us. It's time we were leaving, Jim," said Douga. "We appreciate your hospitality, your tea, and your explanation of your fine rig here."

"We'll see you again," added Billo.

We all shook hands after I explained that this was a custom on Earth between friends. I walked out to the craft with them, and as they entered, Douga looked back and said, "Remember our schedule now, every last Sunday of the month."

"I won't forget. See you later, fellas."

Douga looked down at me for a moment. "73s," he said and smiled. "I know there is no 's' on it, Jim, but take care." He entered the craft, the stairs went up, and the door closed. A row of lights came on and a humming sound became more intense. I moved back away from the craft as it started to rise gradually, picking up speed. In a few moments it was out of sight.

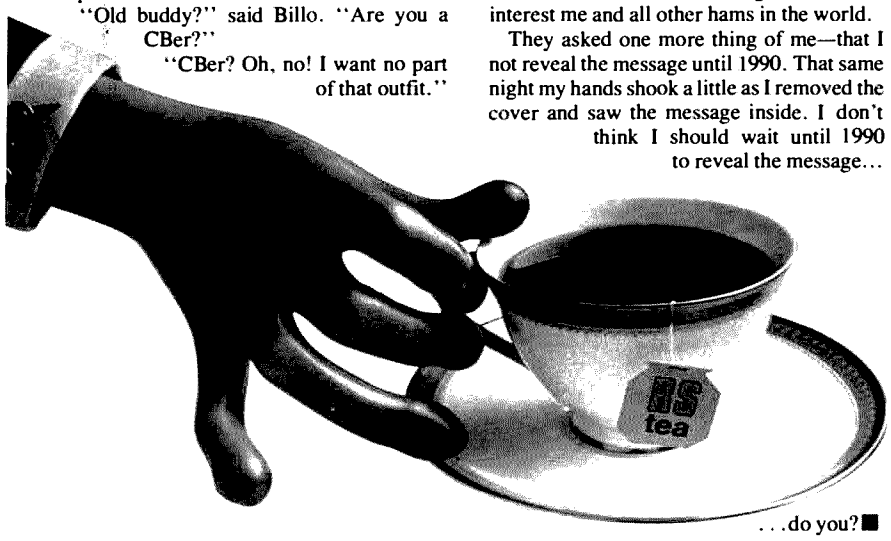
News for Hams Everywhere

I came back into the house and into the shack. The black box was still there, but for some reason I didn't expect it to be. It was now close to 5 a.m., so I went back to bed. At 6:30, the XYL woke me, and I dressed for breakfast and got ready for work. She mentioned that she hadn't slept well and had crazy dreams about strange people out in the back yard.

Three months have gone by since that memorable night. During that time I connected the Starbeam into the 830, and you can imagine the results. I call any DX station I hear, once, and I am QRP into the Starbeam. I always get 59 plus, and I have worked all countries on all bands. It has gotten so it isn't fun any more, except for the last Sunday in every month, of course.

During contact one Sunday not too long ago, I was saddened to hear from Douga and Billo that they had decided not to return to Earth for reasons they couldn't explain to me at the time. They said that the Starbeam was mine to keep, and that if I removed the top cover I would find a message that would interest me and all other hams in the world.

They asked one more thing of me—that I not reveal the message until 1990. That same night my hands shook a little as I removed the cover and saw the message inside. I don't think I should wait until 1990 to reveal the message...



...do you? ■

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MRF428**	150W	55.00	125.00
MRF433	12.5W	12.00	30.00
MRF435*	150W	42.00	90.00
MRF449,/A	30W	12.50	30.00
MRF450,/A	50W	14.00	31.00
MRF453,/A	60W	15.00	35.00
MRF454,/A	60W	16.00	36.00
MRF455,/A	60W	12.00	28.00
MRF458	60W	20.00	46.00
MRF460	60W	18.00	42.00
MRF464*	80W	25.00	60.00
MRF466*	40W	18.75	48.00
MRF475	12W	3.00	9.00
MRF476	3W	2.75	8.00
MRF477	40W	11.00	25.00
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MRF239	30W	138-174	15.00	—
MRF240	40W	138-174	18.00	—
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MRF250	50W	27-174	20.00	46.00
MRF260	5W	136-174	7.00	—
MRF261	10W	136-174	9.00	—
MRF262	15W	136-174	9.00	—
MRF264	30W	136-174	13.00	—
MRF607	1.75W	136-174	3.00	—
MRF641	15W	407-512	22.00	—
MRF644	25W	407-512	24.00	54.00
MRF646	40W	407-512	26.50	59.00
MRF648	60W	407-512	33.00	69.00
2N3866*	1W	30-200	1.25	—
2N4427	1W	136-174	1.25	—
2N5591	25W	136-174	13.50	34.00
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Are you plagued by power-line noise on the low bands? Bothered by noise from an unknown source? There is a solution that requires no special tools or hard-to-find materials, one that could solve or greatly reduce this noise and provide you with a better signal-to-noise ratio—it's a loop antenna with an innovative twist.

Loop Antennas

Loop antennas are already familiar to many people; they've been used for direction finding on-board ships and in land stations for many years. Their construction has always been rather complex, involving the use of copper tubing as an electrostatic shield. Coax has also been used with fair results [1,2,3]. Previous emphasis has been on obtaining a figure-eight pattern using two nulls, a method that requires electrostatic shielding. Shielding the loop also helps reduce rain static noise. In short, for direction finding where you need a good null and the null direction must be accurate, shielding is a definite requirement. In terms of noise elimination, a single null is preferable; you want to eliminate interference from one direction but not reduce the signals from other directions.

Drawing on my past experience of building loop antennas for 160m before World War II (I used bicycle-wheel rims—they were wooden in those days—to support the loop wires), I began looking for an easy way to again do the same thing. It came to me that a toy called the Hula Hoop might be the answer. I purchased two Hula Hoops; one antenna I constructed with an electrostatic shield and the other without.

I made the shield by wrapping aluminum foil—the type used to repair rain gutters—around the Hula Hoop, leaving a gap at the top to prevent short-circuiting the received signal. It was a difficult task, and the final appearance wasn't very professional. When I was finished, I compared the two loops to see how well they rejected power-line noise. The rejection was about the same, but signals were slightly weaker on the shielded loop.

Because it looked better and gave a slightly better performance, I decided to go with the unshielded loop. Although it wasn't intentionally designed to give a single null, the receiving pattern turned out to be just that. This was probably due to the unbalanced coaxial feedline.

I obtained the cardioid pattern (Fig. 1) from a local broadcast station (daytime) on the upper end of the band. Although the null is quite good, I can't guarantee the accuracy of the null direction. This makes no difference if you are just trying to null a noise source.

When the project was finished, I decided to see if any articles had been written already on the subject. Sure enough, I found at least one—there may be more. W5DS wrote an article for *QST* that was published during the last sunspot minimum.[4] This article describes using a Hula Hoop and even the same aluminum foil that I used. Foiled again...but then again, I decided not to use the foil. In addition, due to its internal construction, the W5DS loop's receiving pattern was the familiar figure eight. Because the essential Hula Hoop idea has already been presented, we'll have to call this project "The Hula Hoop Loop Revisited."

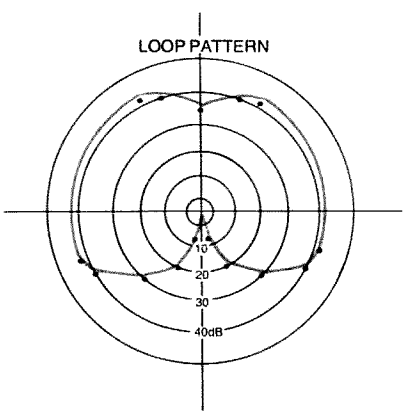


Fig. 1. The Hula Hoop Loop's receive pattern.

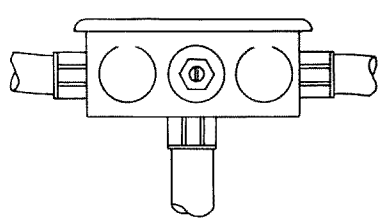


Fig. 2. PVC adapters and a breakout box make for easy mounting.

Construction

Hula Hoops are readily available in toy stores. The latest fad is to make them look like peppermint candy—they even put peppermint candy inside the hoop to give the proper smell!

To find the place where the loop is fastened together, remove the label; you'll find small staples that can easily be pried out with a sharp pick. The hoop core diameter is about the right size to fit into a PVC ½-inch end adapter. These have threads on one end and a body for the loop to fit into on the other. Using PVC cement, glue one of these adapters on each end of the hoop (Fig. 2). While you wait for it to dry, prepare a single gang electrical "handy box" normally used for wall switches by removing the two end knockouts plus one on the bottom. You must also mount a tuning capacitor in the box. It should have a value of about 300 pF for the 160m band. You can use an Arco 303 (65-365-pF) padding capacitor if you find one in your junk box, or use a tuning capacitor from an old pocket transistor radio. If neither of those is available, Circuit Specialists in Ari-

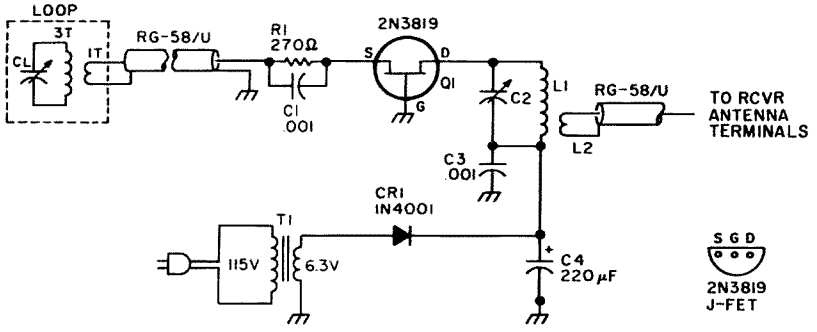


Fig. 3. This preamplifier boosts the signals back to a reasonable level. It's a simple circuit using a FET in a grounded-gate circuit that gives about 20 dB of signal gain.

zona has tuning capacitors in its catalog.[5] Naturally, the size of the hole for mounting the capacitor depends on the type.

The loop is now ready to be mounted into the box. Insert the ends into the box and secure the adapters with ½-inch locknuts of the type used for electrical conduit installations. Before locking tight, orient the hoop so it's at right angles to the box top. Once that's together, it's time to feed in the wire.

Internal Wiring

The wire used for the loop should be flexible but still stiff enough so that it won't buckle when pushed around the loop. (I used #18 AWG multi-stranded insulated wire.) If necessary, you can use a stiffer piece of wire as a fish line to pull each loop through. To prepare the wire for the loop, cut a 30-foot length and slowly start to feed it into the hoop. After the wire has been passed around three times, tape the ends temporarily to the outside of the Hula Hoop. Next, pass around another single turn of wire 10-feet in length, creating a one-turn loop. The one-turn loop will be connected to the coax. Now mount the capacitor and connect the ends of the three-turn loop to the rotor and stator. Make sure that the rotor is not grounded to the box; if it is, you'll have to insulate the shaft.

Before the coax is connected, the mast that will support the loop must be mounted. (The mast should not be metallic—a length of heavy-duty PVC can be used for this purpose.) If you do use PVC, I suggest a length no longer than 3 feet. You can use metal pipe only if there is an insulating section between it and the handy box. I've found these precautions improve the depth of the null.

Secure the mast in the same fashion as the hoop with an end adapter and locknut. Feed the coax up through the bottom of the mast or through a hole in the side of it. Pass the coax up the mast until it reaches the box. Here, connect the shield and inner conductor to the one-turn loop. Be sure that the coax doesn't short out against the box. Use tape or shrink tubing to prevent this from happening. You can now mount a blank handy-box cover to the top of the box to complete the assembly.

After you check out the loop, it's wise to seal the cover and any openings with silicone adhesive.

Adjustment and Operation

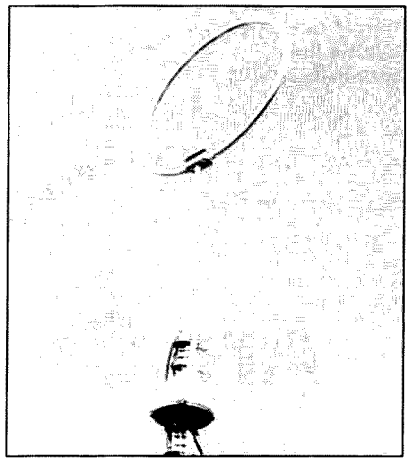
The antenna can now be connected to a receiver input for preliminary adjustments. Select the frequency you use most often and, if the noise source is available, point the loop to give maximum signal and adjust the capacitor to give maximum noise. (I did my preliminary adjustment with the loop in the shack; otherwise, it takes two people to make this adjustment.) Once adjusted, rotate the loop to give minimum noise. The loop should be approximately at right angles to the maximum position. Rotate the loop 180 degrees and only a small dip will be found.

"Signals that were unreadable because of the power-line noise are Q5 with the loop."

You'll immediately notice that the signals on the loop are weaker than on the regular receiving antenna, but the signal-to-noise ratio should be greatly improved. The bandwidth of the loop is about 60 kHz, and it will receive signals across the entire 160-meter band.

Preamplifier

In order to boost the signals back up to a reasonable level, I constructed a pre- amplifier (Fig. 3). It's a simple circuit using a FET in a grounded-gate circuit that gives about 20 dB of signal gain. The preamplifier is built in a metal box to prevent stray pickup, and it includes the power supply. I used coax fittings to bring in and take out the signal. The capacitor is the same type used for the loop and is peaked for maximum signal. It can also be stagger-tuned with the resonant frequency to give a broader bandwidth.



If you suffer from power-line noise, the solution to your problem may lie in a simple Hula Hoop.

Using the loop, I have found that signals that were unreadable because of the power-line noise are Q5 with the loop. The loop directivity has little or no effect on sky-wave signals and therefore can be set on the noise source and left there, providing the noise is always from the same direction. This project should cost less than $15, including the preamp. It's simple enough that no one should have difficulty in its construction. Although I haven't tried it, you should also be able to use the loop on 75 with fewer turns; since there is ample room, it can possibly work on 160 kHz with additional turns.

By the way, the power company has since replaced the transformer that was causing my noise problem, but there is still some residual noise, which is easily nulled out. ■

References

1. "Loop Antennas," John R. True W4DQ, *Ham Radio*, December, 1976.
2. *The Low Frequency and Medium Frequency Radio Scrap Book*, Ken Cornell W2IMB.
3. *ARRL Antenna Handbook*.
4. "The W5DS Hula Hoop Loop," Bob Edmund W5DS, *QST*, October, 1975.
5. Circuits Specialists Co., PO Box 3047, Scottsdale AZ 85257.

Parts List

R1	270Ω ¼W	271-1314
C1, C3	.001 μF ceramic	272-126
C2	300 pF variable	
C4	220 μF 16V electrolytic	272-1006
CR1	1N4001	276-1101
T1	6.3-V secondary	273-1384
L1	100-μH choke	273-102
L2	10 turns around cold end of L1	
Q1	2N3819	216-2035
	RG-58/U	278-1326

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Are Sine Waves Sacred?

W6HDM thinks not and gives a convincing argument for abandoning 60-Hz ac.

Our perceptions of the world around us, naturally enough, can lead us to the assumption that *other* formats, *other* procedures, and *other* viewpoints than ours can justifiably be relegated to oblivion, deserving no further consideration. Take that nice sine wave pictured in Fig. 1(a) that the utility endeavors to pipe into our home or workplace. Since Edison's pioneering work in power generation and distribution, virtually no further protest has been heard against the use of sine waves or ac in general. Of course, Edison—not withstanding his brilliant record as an inventor—committed the intellectual faux pas of rejecting ac altogether; he didn't understand the mathematics involved.

It has been about a century since Edison's desire for dc was overruled, and the world has become crisscrossed by a vast network of ac power lines. Would one dare suggest, at this late date, that some *other* waveform than the sinusoid might be more suitable for the transmission, distribution, and consumption of electric power? Such, indeed, is the gist of this article, and the reader is invited to judge whether such a suggestion smacks of boldness or recklessness—or perhaps of something in between.

At the very outset, remember that whatever beauty the sine wave was endowed with at the generator is generally conspicuous by its absence by the time it gets to your wall socket. In many cases, it is likely to resemble the harmonic- and transient-ridden wave depicted in Fig. 1(b). This comes about via thousands of SCRs and other solid-state power devices, motors, nonlinear loads, reactance, arcs, sparks and faulty contacts, storm-induced currents, etc. The idealized sine wave of the textbooks, with only its fundamental frequency and no transients or noise, is *not* what we plug into.

This situation is food for thought—if such a messed-up *former* sine wave is what we usually get in actual practice, it might indeed be advantageous to start out with some *other* waveform. Even assuming that another type of wave would also be subject to the brutalities inflicted on the sine wave, the overall situation resulting just might exhibit some desirable features! And if the vested interests in the status quo are too strong for a change in the way our large cities are powered, maybe our new waveform can still give a good account of itself in isolated communities, on shipboard, or in space vehicles.

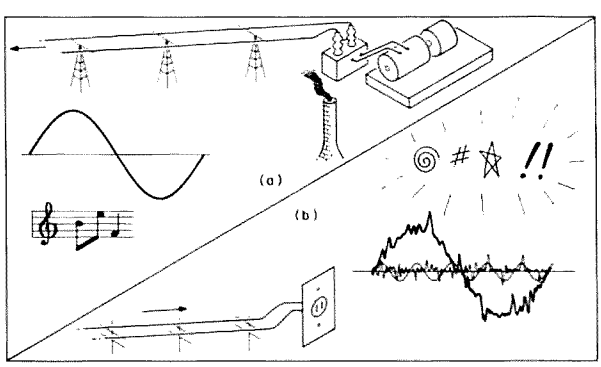


Fig. 1. The sine wave from the utility is esthetically pristine and electrically "pure," but alas, corruption has set in by the time the power reaches our wall socket.

Admittedly, fantasy can ensue from that kind of thinking. It will prove profitable, however, to bear in mind that imaginary scenarios often are invested with more than a mere modicum of truth. We knew all the time, did we not, that Dick Tracy's wrist transceiver was just around the corner? And did not the space weapons of Buck Rogers make sense just because we sensed their imminent appearance?

The nature of the fantasy in which we will immerse ourselves here is simply the pretense that Thomas Edison mostly *did* get his way and that most of present-day electric-power transmission and distribution *is* dc and not ac. (Surely, you will recall that Edison did not like ac because volts, Amps, and Watts often did not add up properly in a distribution system when tallied with common sense arithmetic; and there were others accomplished in the electrical technology of the day who also frowned upon the violation of Ohm's "law" in ac circuits.)

So, here we are. It is 1986, and (we pretend) dc is the fashion of the day. There is, however, much ferment and controversy because several of the more progressive utilities have wired up isolated towns and communities with ac distribution! They have demonstrated beyond reasonable doubt that ac systems are much more flexible and versatile—thanks to the use of transformers—than dc systems! Moreover, by using 60-Hz sine-wave generation, they have shown the path to greatly-upgraded industrial processes via the induction motor!

Whether formulated in so many words or not, the burning question in our pretend world is: What shall be the future format of electric power distribution, ac or dc? And if ac, what frequency and waveform? It is universally conceded that 60-Hz sine waves make much sense, but there are contenders and lobbies for other ac parameters, too.

In particular, a think tank formed by a group of overaged, unemployed engineers has advanced compelling arguments for a standardized generation and distribution format using 100-Hz near-square or trapezoidal waves. Inasmuch as some of these industry-rejects are hams, it would behoove us to give

their theories due consideration (even if they are seemingly on the wild side). In so doing, we will at least be acting more wisely than our corporations, which relegate engineers to the scrap heap when the blush of youth fades from their cheeks.

Trapezoids

A *trapezoidal* waveform is advocated as being invested with a good blend of theoretical and practical pluses. Fig. 2 depicts such a wave, and shows it to be composed of the fundamental frequency plus two harmonics, 3f and 5f. This, of course, is old hat to those of us acquainted with the Fourier theorum of wave composition. (An interesting aside is that the fundamental frequency has greater amplitude than the composite trapezoidal wave; this is not a draftsman's boo-boo and will be dealt with later.)

Right off the bat, our curiosity is aroused with regard to the trapezoidal waveform. If one is to go in this direction—toward harmonic-rich waves—why not just select a nice 50%-duty-cycle *square* wave and be done with it? In answer to this very natural question, the august body of practical scientists of the think tank replies that the square wave was, indeed, their first consideration. It was, however, quickly and clearly evident that true square waves, or even "practical" square waves, were possessed of two overwhelming disadvantages. First, it would be impractical to try to generate, transmit, and distribute square waves because reactive loads and stray reactances would play havoc with the high-frequency components of such waves, thereby distorting their shape in unpredictable ways. Second, square waves, as is shown in Fig. 3(a), contain numerous high-frequency harmonics which would create interference with radio, TV, and with communications systems in general.

Assuming that the square wave would be otherwise still worthy of consideration, Fig. 3 also confirms something of relevancy. This is that a near-square wave can be formed from just a few harmonics. Thus, in Fig. 3(b) we see a trapezoidal wave essentially made up of four harmonics, 3f, 5f, 7f, and 9f. Instead of many hundreds or many thousands of higher frequency components, this waveform can be tailored to carry no more than four or so. It can be appreciated that if we allowed, say, ten harmonics, the waveform for certain practical purposes would be square but without power to create radio and communications interference. This, it is contended, is a fortuitous phenomenon inasmuch as steep-rise and -fall square waves are not practical to distribute and feed to loads anyway. It is true that nothing yet has been cited to justify consideration for such a compromise square wave. Accordingly, let's see what the behavior of such a waveform might be and how it stacks up with the sine wave. (And most important, let's make the comparison in terms of things which exist in actual practice.)

New Waveform Needs

A natural question is, why the sudden interest in square-wave power? Why bring up a non-sinusoidal waveshape now? After all, practical electrical technology has been more than three quarters of a century in the making. Surely the virtues of other than sine waves would not have escaped consideration during this long evolutionary period.

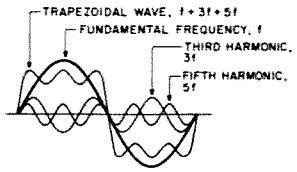


Fig. 2. Trapezoidal wave composed of just three frequencies. The Fourier theorem of wave composition states that any wave may be resolved into a fundamental frequency and a number of harmonic frequencies with appropriate phase and amplitude relationships.

Indeed, the knowledge was there, even at the turn of the century. However, two things were lacking until relatively recently. First, the need for a better waveshape did not manifest itself for a long time. As long as the primary type of load was incandescent lighting and the user of electric power received a fairly good sine wave, no case could be made for another waveform. Second, the processing equipment for forming and transmitting near-square waves evolved with the advent of semiconductor power devices, especially the SCR. Previous methods for doing this were neither economically nor technologically suitable. Also, earlier core materials would have exhibited objectionable losses if subjected to low audio frequencies residing in a trapezoidal wave. Today, however, transformers are both feasible and cost-effective for manipulating 100-Hz trapezoidal-wave power.

Admittedly, if your utility suddenly switched over to 100-Hz trapezoidal power, there would be some difficulties, perhaps even some malpractice suits! For one thing, electric clocks would run too fast, by the ratio of 100:60. So, too, would all 60-Hz induction motors. (This might cause your washing machine or dishwasher to work better than ever, but I will not belabor this point!) Note, however, that the motors overspeed because of the postulated 100-Hz line frequency, *not* because of the new waveshape.

This gets us into an interesting topic—the behavior of motors on non-sinusoidal waves. Fortunately, a good deal of practical experience has been accrued in this area because of the electronic generation of square waves. The simple saturable-core, two-transistor inverter is a classical example of a square-wave power source. Also, SCRs have been much used in higher-power versions. There is much interest right now in motor operation from inverters because of solar- and wind-powered units for homes (as shown in Fig. 4). Here, again, we find ourselves in a situation which did not exist to any great extent until the commercialization of solid-state power devices.

There are several reasons why 100 rather than 60 Hz is suggested for trapezoidal-wave power. Many feel that 60 Hz is marginal with respect to eye fatigue from flicker. This is especially true for fluorescent illumination—ask any draftsman! 100 Hz would blend in nicely with the metric system. And, with 100-Hz distribution systems, worthwhile savings would be realized in the size and cost of transformers.

Waveform Character

Although most of us are vague as to where or when we absorbed the information, we know that the peak value of the sine wave is not very useful beyond its capacity to break down insulation. (A couple of exceptions are in the development of high voltage in voltage-multiplying rectifier circuits and in the turn-on impulse of fluorescent lamps.) What generally gets the job done in electrical loads is the rms value of the sine wave, and this is only approximately 70% of the peak value. In motors and in other electromagnetic devices, usefulness of the peak is even less because it is the average value that does the work. The average value of the sine wave is only about 64% of the peak value. In sharp contrast, the peak, rms, and average values of a square wave are the same! For practical purposes, this remains true for a trapezoidal wave with about seven or more harmonics.

It is easy enough to see that the trapezoidal wave has some of the desirable features of square waves, and without the interference-prone higher harmonics. And it certainly is going to be kinder to transformer and motor insulation, to rectifiers, and to filter capacitors than sine waves! Also, certain instrumentation and computations could be less confusing with trapezoidal than with sine waves.

The close resemblance to, and the easy derivation from square waves suggests that the low-level manipulation of trapezoidal waves can be accomplished readily with digital-logic circuitry. Such manipulation can include power-factor correction and the generation of polyphase formats. These and other techniques stem from the precision of logic circuits in timing applications.

One reason that the trapezoidal wave tends to be benign to apparatus originally intended for sine-wave operation is that these waveforms are not drastically different in their composition; neither has any dc component or even-harmonic energy; actually, the harmonic constituency of the "wall-socket" sine wave and the limited-harmonic trapezoidal wave can be surprisingly similar. By appropriately tailoring the amplitudes and phases of some wall-socket sine waves, you could form a trapezoidal-like waveform. (In other words, what started out as a pure sine wave reaches us quite distorted with third, fifth, and higher harmonics.) From the use of solid-state inverters, we know that many kinds of electrical loads have been successfully operated from square waves. It would be natural to anticipate even better results from trapezoidal-wave power.

Note from Fig. 2 that the sine-wave component of a square or trapezoidal wave actual-

ly has a higher peak value than the composite wave itself. This, of course, is not visible on an oscilloscope, which shows only the *envelope* of the composite wave. One must perform a Fourier analysis or plot the graphical composition of the harmonics to appreciate this.

Now, it appears that because the peak of the sine-wave fundamental is considerably greater than that of the composite square wave, the rms value of the sine wave is greater than that of the composite square wave. This, however, is not so. Actually, it turns out that the rms value of the fundamental sine wave is about ten percent *less* than the rms value of the composite square wave of which it is a part. What this means is that a square wave should have an rms value ten percent *greater* than the rated rms sine-wave voltage stamped on the nameplate of the motor.

Although no mathematics was used in arriving at this conclusion, it naturally follows from the Fourier theorem and from the relationships of peak and rms voltages in waveforms. It is well known, however, that inverters used for driving motors often do not impress 110% of rated sine-wave voltage on the motor; indeed, it is more like 90% in practice. The reason for this is that many motors would develop excessive temperature rise from a 110% square wave due to increased losses from eddy currents and hysteresis. For, even though the inductance of the motor or of an external inductor strips higher harmonics from the current waveform, these harmonics in the voltage waveform still can cause added dissipation in the motor. It is not difficult to design the motor to minimize such losses, but as we know, most 60-Hz motors were not envisaged for use with a square-wave source.

When the driving voltage has the nature of the trapezoidal waveform advocated, it is found that motor losses are less than when operating from a square-wave source. Accordingly, it will be found that 100% of the sine-wave rated voltage can be applied. (Incidentally, many of the "true" rms digital multimeters are just what the doctor ordered for measuring the rms value of low-frequency trapezoidal waves!)

Recapitulating, ac motors driven from a trapezoidal-wave source tend to develop near-optimum performance. This is because either self-inductance or external inductance causes the torque-developing motor current to be nearly sinusoidal, and because the trapezoidal voltage waveform is devoid of the higher harmonics present in a square wave. It is, of course, true that the strong third, fifth, and seventh harmonics in a trapezoidal wave still can degrade the efficiency of the motor; practical experience seems to indicate that most 60-Hz motors don't fare too badly.

Interference

It is common knowledge that a pure sine wave contains no harmonic frequencies above the fundamental and is, therefore, unlikely to interfere with radio-frequency systems. It is also recognized that the ideal square wave is capable of providing a spectrum of harmonic frequencies covering all communications services from low-frequency systems to millimeter equipment. Indeed, even the ordinarily-encountered, "practical" square waves, such as are produced in switching power supplies, can blanket many communications bands with severe noise interference. This suggests that sine waves are the good guys and square waves are the bad guys. However, it has been pointed out already that the nice sine wave is a textbook entity not too often encountered at the wall socket. The distortions that characterize the voltage and current waveforms of utility power as well as the transients and noise that come along for the ride create numerous problems in communications gear and in computer equipment.

Inasmuch as the practical sine wave has tarnished credentials and the practical square wave never had any, the trapezoidal wave with a few allowed harmonics begins to appear in a more favorable light. It remains to be shown that such a wave is at least as satisfactory as the sine wave for power purposes. To be sure, it will also be messed up at the wall socket. However, such a wave might be easier to clean up than a transient-laden sine wave. This is because its nearly flat top would allow more effective use of transient-clipping devices such as back-to-back zeners, MOVs, or similar devices. Interesting, too, is the fact that a little rudimentary filtering imparted to a trapezoidal wave readily yields a near sine wave of better quality than we are accustomed to monitor now at our wall sockets!

Electric Shock Hazard

Tissue damage and heart fibrillation are very much a product of the amount of current passing through the body. At moderate voltages—those likely to be encountered at home or at work, i.e., 120 or 240 volts—the initial contact resistance of the skin figures predominantly as the current-limiting mechanism in most accidental contacts with the power line. If you are destined to be shocked by a 120-volt line, it would be better, other things being equal, to be subjected to a trapezoidal wave than a sine wave. The reason is that the peak voltage of the sine-wave line is about 170 volts compared to the approximately 120 volts of the trapezoidal line. It is likely that 170 volts will establish a lower resistance contact with the skin than 120 volts, at least during brief accidental shocks. Although we are in a somewhat controversial area here, it does appear that the high peak of the sine wave increases the danger from a momentary shock.

Corona

A considerable power loss occurs in high-voltage transmission lines due to ionization of the air, or corona. Among other parameters,

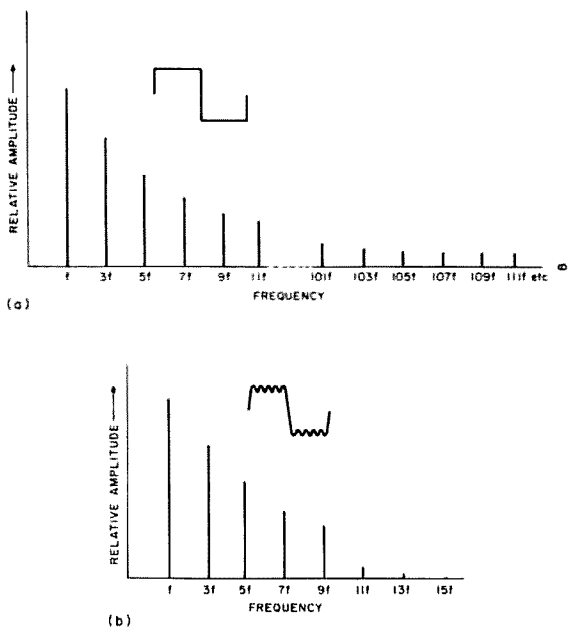


Fig. 3. The harmonic spectra of square and trapezoidal waves. (a) Harmonics in a square wave—the harmonic frequencies go on forever (or almost). (b) Harmonics in a trapezoidal wave—a limited number of harmonics suffices.

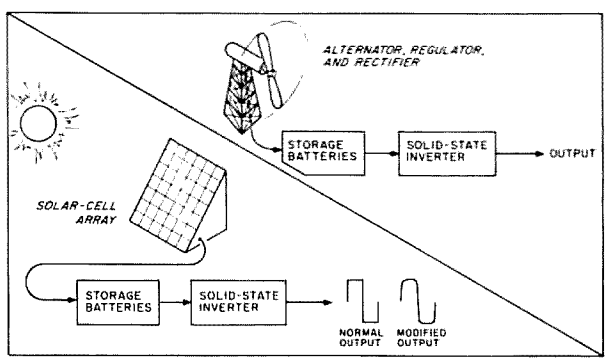


Fig. 4. Trapezoidal waves are readily obtainable from alternate-energy systems. The square-wave output from inverters is easily modified into the more benign trapezoidal shape.

corona loss is a function of voltage. Inasmuch as the peak voltage of a sine wave is about 40% higher than that of a trapezoidal wave having the same rms voltage, it would appear that more efficient transmission of electric power could be expected with the trapezoidal than with the sine wave. At the same time, QRM from the corona should also show a worthwhile reduction. A similar argument prevails for the sparking and arcing across leakage paths of high-voltage insulators: the less peak voltage, the better.

Fluorescent Lamps

Both the use of the trapezoidal wave and an increase in frequency to 100 Hz would tend to produce a steadier light from fluorescent lamps. Some fluorescent-lamp circuits that now operate from 60-Hz sine-wave power probably would not start if nothing else were done but changing the power-line format to a trapezoidal wave. This is because sufficient peak voltage would not be available during the start phase of operation. Various strategems could be used to circumvent or overcome this malfunction, however. Manufacturers would likely market a special ballast inductor or transformer for the purpose. A number of purely electronic techniques might also be employed in which a momentary transient of high voltage could be developed. In any event, the design of new or replacement fixtures for accomplishing the purpose would not present any severe technical or cost problems. And once trapezoidal-wave power became fairly commonplace, there is little doubt that the fluorescent lamps themselves would be optimized for reliable starting at the lower peak voltage associated with the new waveform.

Trapezoids and Dc Power

A wide spectrum of electronic equipment makes use of power supplies which rectify and filter the ac from the utility. For a long time, virtually all such supplies used an isolation or power transformer. In any event, such transformers operate just about as well from a trapezoidal wave as from a sine wave, although the mathematics of design would not be quite the same if one decided to dedicate the transformer for a specific waveform. Although square waves would introduce some problems, the trapezoidal wave can be expected to be completely acceptable to transformers, especially if any reasonable safety factor was incorporated in the original design. The design of new transformers to accommodate the trapezoidal waveform certainly would present no problems.

The rectifier elements would be spared the necessity of being rated to withstand peak voltages appreciably higher than average or rms, as is the case with sine waves. The rectifier elements "see" the envelope of the trapezoidal wave, just as on the oscilloscope. This is fortuitous because the rms, average, and peak voltage in a trapezoidal wave are nearly identical.

Note that the high peak of the fundamental component as shown in Fig. 2 is not experienced by the rectifier elements. As previously stated, only the envelope of the composite wave manifests itself insofar as peak voltages are concerned. Although this may be of small consequence in low-power equipment, it has very favorable electrical and economic significance in the design of high-voltage power supplies which are called upon to provide appreciable power as well.

Another advantage of the trapezoidal wave is in the residual ripple following rectification. Simply stated, less filtering is needed than for sine-wave operation of the supply. And, unlike square-wave operation, there is much less trouble with electrolytic capacitors that do not function well at high-ripple frequencies. Similarly, because there is almost negligible harmonic energy at high-ripple frequencies, filter chokes can do their job without being bypassed for high frequencies by stray capacitance.

It may be argued that some supplies, such as voltage multipliers which depend upon peak voltages to develop their high voltage, would not deliver expected voltage. This contention is valid for no load or for very light load. But if any appreciable current is required, the improved regulation which will result with the trapezoidal wave would be a compelling feature (see Fig. 5). Regulation is improved because there is less "dead time" between rectified pulses.

All things considered, my proposed trapezoidal wave should be very kind to electronic power supplies!

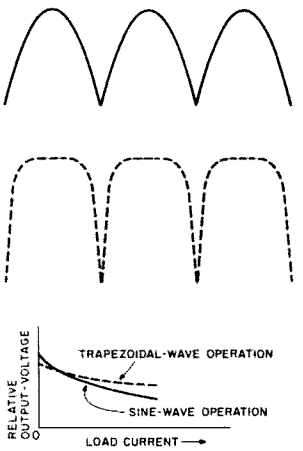


Fig. 5. Dc power-supply behavior for sine and trapezoidal waveforms. Top: full-wave rectification with a sine-wave. Center: full-wave rectification with a trapezoidal wave. Filter capacitors have more time to charge and are allowed less time to discharge. Bottom: general form of regulation curves. Note higher light-load voltage for sine-wave operation—this might be of significance in certain applications of voltage-multiplier circuits. For most applications, the better regulation of the trapezoidal-wave operation would be considered advantageous.

Trapezoids and Electric Motors

Square-wave operation of motors is a mixed bag. On the one hand, induction and synchronous motors don't like the square waveform; the harmonics therein contain increased eddy-current and hysteresis losses. These harmonics often develop countertorques that interfere with smooth operation and sometimes inhibit self-starting. However, the self-inductance of such motors often comes to the rescue by attenuating much of the harmonic energy, thereby making the waveform of the motor *current* near-sinusoidal, or approximately trapezoidal. Whether or not adverse operation will be experienced depends to a great extent upon the design and construction of the motor. If the self-inductance is relatively high and if thin laminations of quality-grade motor steel are used, the motor is very likely to start and run normally. Also, it is generally feasible to insert a small inductance in series with the motor to provide the small amount of filtering needed for satisfactory performance. In any

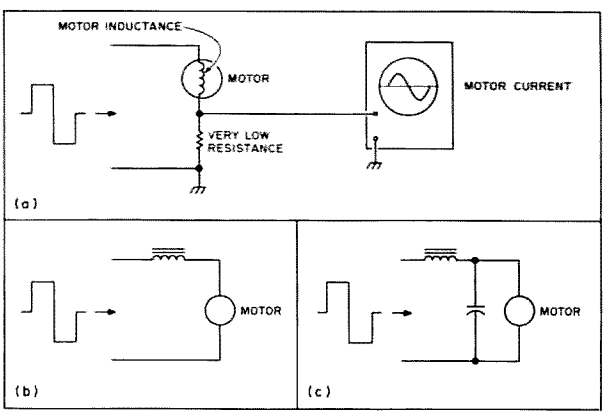


Fig. 6. The rationale for trapezoidal-wave operation of ac motors. (a) Setup for monitoring motor current reveals that it tends to be trapezoidal even though square-wave voltage is applied to motor. (b) Instead of relying upon motor inductance to strip higher harmonics from the square wave, a small external inductor can be used. (c) For small ac motors, an L-section low-pass filter can be a cost-effective way of ensuring that the motor actually "sees" a near-sinusoidal or trapezoidal wave.

event, it is motor *current* that produces the turning torque, not motor voltage.

If, however, we start out with a trapezoidal wave, the chances are enhanced that most motors will behave well. The third and fifth harmonics of such a wave many still interfere with certain small motors, but here again a small inductance connected in the line tends to alleviate trouble. Moreover, with small motors it is cost-effective to use an L- or pi-section low-pass filter in the line for even better attenuation of harmonic energy.

Series motors, otherwise known as universal or ac-dc motors, also run well from square waves and may even develop improved torque characteristics. Sometimes, depending upon a number of motor-design features, commutation problems may be experienced in the form of excessive sparking. This can usually be remedied by connecting a capacitor across the armature. Here again, less trouble is likely if one starts out with a trapezoidal rather than a good square wave. Added insight into these matters is provided by Fig. 6.

The situation with regard to the voltage that should be applied to a motor operating from non-sinusoidal power has already been alluded to. Additional insight is readily attained by consideration of the nature of the good square wave. One then can closely approximate the situation prevailing for the near square wave or trapezoidal wave. Recall that the rms, average, and peak values of the square wave are one and the same, and note the fact that it is the sine-wave fundamental component of the square wave which actually develops the electromagnetic torque in a motor. The harmonics can be considered to come along for the ride on the impressed waveform but do not figure prominently in motor operation (except for the alluded-to tendency to somewhat increase dissipative losses).

Conclusion

This plain-language discussion has endeavored to show that a trapezoidal wave with a limited number of harmonics manifests the salient advantages of both the sine wave and the square wave. At the same time, the proposed trapezoidal wave does not have some of the drawbacks of either sine or square waves. In presenting the case for trapezoidal waves for power lines, it was also pointed out that our present utility power techniques often fail to deliver a really good sine wave at the wall socket. This being the situation, certain arguments for sine waves fall by the wayside in actual practice.

It is well known that professionals and bureaucrats have notoriously missed the boat in past considerations of technical innovations. Also, it is a feather in the ham's cap that amateur radio often has been the source of new and exciting ideas that have resulted in widespread implementations of them. This being true, OM, would you welcome the trapezoid into your ham shack? ■

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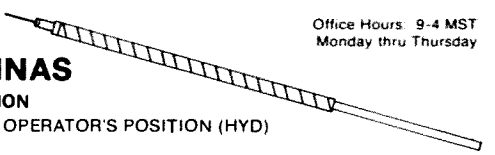
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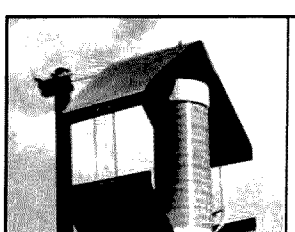
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Transmitter Hunters: Here's Your Ammo For Tracking

For the serious competitor—spend a few evenings with a soldering iron and get the jump on the pack.

A short while ago the age old pastime of transmitter hunting was revived here in Omaha. There have been a number of enthusiastic hunters, but they have discovered that there is a great lack of decent direction-finding equipment.

There were only two of us who could track with any ease. I had a spectrum analyzer hooked up for mobile operation and Bill WA9ASD, a transplant from Chicago, used to be a very active hunter there, but he had become a bit rusty.



Photo A. Inside this rf-proof can lurks a Tempo S-1 HT.

Most everyone else had thrown together pads, antennas, and other hurriedly assembled paraphernalia in anticipation of having a good time. As it turned out, everyone had a lot of fun and the equipment is improving both in type and application.

I quickly found that the spectrum analyzer is great for getting to the rabbit fast, but is not what one would call portable. I had visions of carrying the inverter and a car battery in a backpack, should the rabbit be in the middle of a field somewhere.

I did have a Tempo S-1, but it did not have an S-meter. I had gone over it very carefully before to see if there was some way to put a meter on it. The answer was still no (at least not with just a meter movement). I wondered how difficult it would be to use an external i-f and meter circuit to do the job. After a little testing, I discovered that the output of the second mixer seemed to have a very wide dynamic range. Looking at it (455 kHz) on the spectrum analyzer and increasing the rf at the antenna, the signal was discernible from about .7 microvolts and tracked linearly up to about 5,000 microvolts, nearly an 80-dB range. 5,000 microvolts was roughly the gain compression point at the output of the mixer at 455 kHz. It looked like a good possibility.

I tried several circuits to do the job with varying degrees of success. The one that finally worked was a CA3089E in a circuit stripped down from its intended use. The IC itself has lots of gain, limits at about 12 microvolts, and has a metering pin that follows input level not quite logarithmically from about 1 microvolt up to about 3,000 microvolts (about a 70-dB range). The result is the circuit in Fig. 1. All of the three models built and tested have a range of 0–70 dB when using a 0–1-milliamp meter movement. So it follows that one should need only a single-step 50-dB attenuator to give 120 dB of range. This is, in fact, the case.

When one is operating at the high end of

this range a new set of problems occur—not with the electronics but with the plastic case of the S-1. One just can't be sure whether the signal is coming from the directional antenna or through the case of the radio. This is a common problem on any transmitter hunt.

Since the S-1 is of a modest size, it fits easily into a one-gallon paint can. With the paint buffed off of the lid where it seals, and off of the bottom cover seal, and the can soldered shut (my brand new paint can had a primer coat inside and the bottom was only a paint gasket seal), I could key up with 10 Watts at two inches from the can and the S-1 didn't even know it was there. The rubber duck was elbowed over against the S-1 with two BNC elbows.

That was good enough rf integrity for me. Maintaining this integrity when adding meters, switches, and BNC connectors has to be done with some care and forethought. The first hole I drilled in the can was for a BNC soldered to the lid. I again tested the rf integrity and found that 10 Watts at two inches was *full* quieting. I put a BNC cap over the newly installed connector and was back to full integrity. The 0.5-pF (or so) capacitance between the BNC's center pin and free space was enough antenna to give a full quieting signal with 10 Watts at two inches.

Next, the meter movement: I used a double-wall construction for this (see photos) and a .001 feedthrough. This passed the "10 Watts at two inches" test the first time.

Third was a three-pole, double-throw toggle switch for the 50-dB attenuator mounted next to the BNC on the lid and shielded. The center pole is grounded at all three terminals to prevent capacitive coupling between In and Out. A two-pole switch gave only 41 dB with the 10k removed (see Fig. 2).

Mounting the meter board, the 12-V regulator, the 9-V batteries (explained later), the power switch for the metering circuit, and meter multiplier switch posed no problem. However, adding an LED as a power-on indicator did. The capacitance of the metal in the diode with free space was enough to fail the "10 Watts at two inches" test easily. Two .01-uF capacitors with very short leads soldered between each LED lead and the can cured the leak.

I did add one more hole to the lid. I had a hard time hearing the S-1 with the cover on if there was much ambient noise, even at full volume. An external speaker seemed in order.

I punched a 1½" hole in the lid and soldered a layer of copper window screen (about 1/16" mesh) inside to reseal it for rf and added the speaker. It failed the "10 Watts at two inches" test miserably! A second layer of screen outside with the center insulated by a Teflon™ washer and meshed at 45 degrees to the original restored the rf integrity (see Fig. 5). The only things left to do were cosmetic.

One may wonder why the concern about rf integrity. If one is certain that the only rf getting to the radio is through the BNC connector on the top of the can, one can also be sure that the indications will be solely those coming in the antenna of choice.

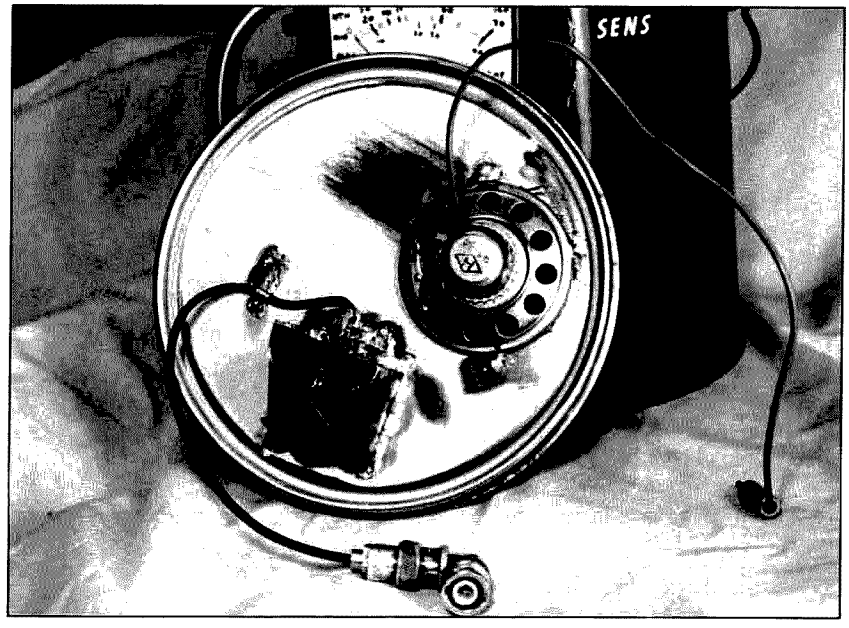


Photo B. Buff the lid around the rim and wherever you plan to solder.

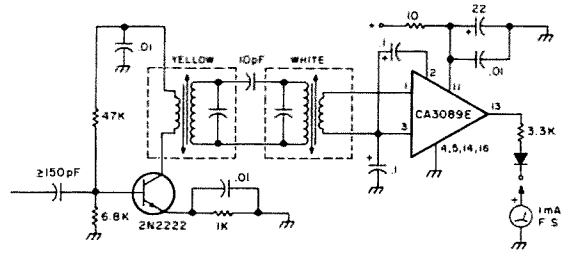


Fig. 1. Schematic diagram.

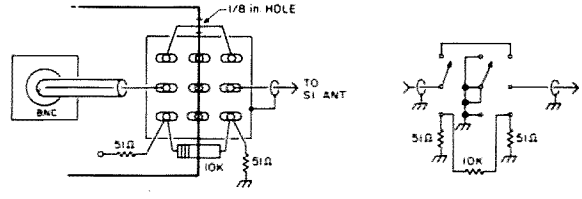


Fig. 2. Toggle switch for the 50-dB attenuator.

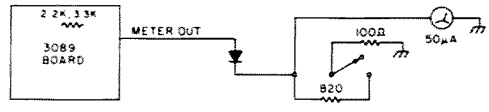


Fig. 3. Optional meter circuit for DFing weak signals.

Board Construction

Component layout is shown in Fig. 6 and the foil-side positive is shown in Fig. 7. The two .1-uF capacitors and the 22-uF capacitor must be tantalums to ensure that oscillation does not occur.

The two i-f cans are scavenged from an old AM superhet transistor radio. The transformers with the yellow core and the white core are used. There will also be a black- and a red-core transformer that are not used. One of these radios can be procured from a friend or neighbor who has an old one (if you don't). Chances are slim the transformers are bad if the radio is in good mechanical shape.

When construction is finished, tune-up is simple. Tune the S-1 to a weak station that is just barely full quieting and tune both transformers for a maximum meter reading.

An optional meter multiplier circuit is shown in Fig. 3 and is about 40 dB full scale in its most sensitive position. This lets one get a fix on a weak, distant station more easily.



Photo C. Use a double wall for the meter mount.

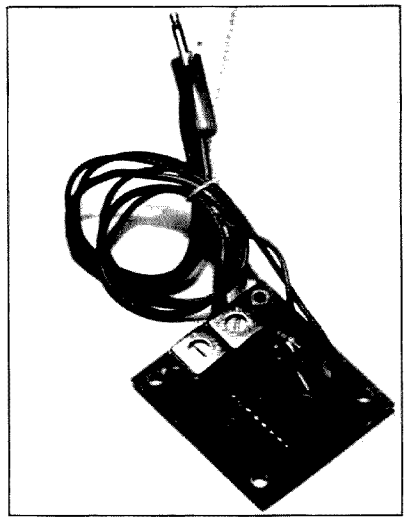


Photo D. A close-up look at the circuit board.

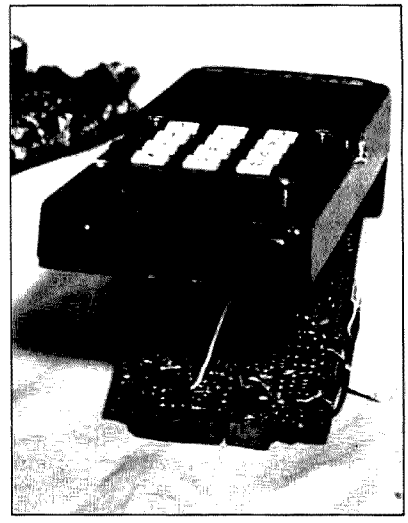


Photo E. Mount the subminiature jack on the bottom right corner of the case.

The 3.3k output resistor was changed to a 2.2k resistor for this circuit.

A few final thoughts—the IC is designed for about 12 V (8–15 V) and current is nearly constant at 22 mA across the range. Performance seems optimum at 10.5–14 V, so I used a 12-volt regulator and a pair of 9-volt batteries in series. Total current demand is about 23 mA, so a couple of the cheapest batteries should work for 2 or 3 hunts. They can get pretty dead before the regulator drops out and the IC gets to its 8-volt minimum and quits.

There is a nearly identical IC, *which in most other applications is a better chip* but has only about 30–35 dB of range on its metered output. It is a CA3189 and *should not be used in this circuit.* I tried one and found it most unsatisfactory.

My Tempo S-2 also has a new jack on its side and the performance is identical except for the antennas one must use.

The power supply is shown in Fig. 4. The 12-V regulator can be any one of the 78X12 series. I used an LM78L12ACH (TO5 package). Note the LED is in series with Vcc and does not draw any extra current.

Connection inside the S-1 and S-2 is as follows: Connect approximately 5 inches of very small coax (RG-174 will do) to a subminiature jack. Mount the jack near the corner of the bevel in the front of the case, as there is sufficient room for a small jack here but no extra space (see Photo C). Next, dress the other end of the coax and connect as shown in detail of the S-1 board (same on S-2). The actual connection is the input pin on the ceramic filter. A capacitor much larger than 47 pF will degrade the performance of the S-1, and less than 22 pF won't couple enough signal out.

Disadvantages: One has to pop the lid every time one needs to adjust the S-1's controls or change frequency and there is, of course, no push-to-talk operation while DF-ing. But, then, one doesn't need that much anyway.

Advantages: Portable, very wide range meter (70 dB—most FM S-meters have only a 20–30-dB range or one has to guess at lights), a cheap addition to an existing radio, and it will work with any radio with a 455 i-f and a discrete mixer.

A footnote: This circuit has been used on the ICOM 4AT, a Regency business-band UHF radio, and a Standard C118. They all needed some isolation to work properly. In all cases the only convenient point to pick off the 455-kHz signal had sufficient baseband noise that the meter gave a substantial reading even with no signal input. The cure was a resistor in series with the 47-pF capacitor in the radio. In the Regency, the optimum value turned out to be 100k; in the ICOM, 47k; in the Standard, 10k.

The ICOM has only about 50 dB of range because it limits in the IC at a lower point than in the S1. The Regency has about the same 70-dB range as the S1, and the Standard also has about a 50-dB range.

To find the proper value of series resistance

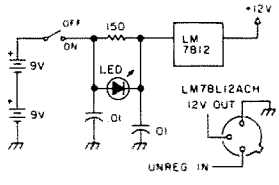


Fig. 4. Power supply.

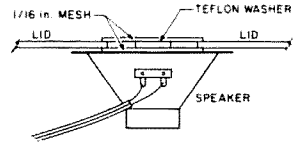


Fig. 5. Two layers of mesh are necessary for rf integrity.

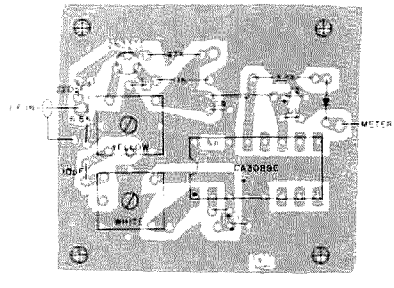


Fig. 6. Component placement.

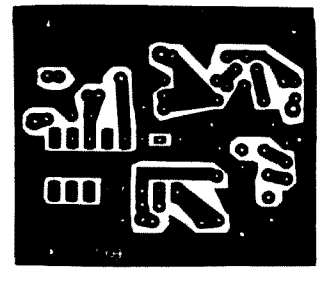


Fig. 7. PC board, foil side.

necessary, place a 1-megohm pot in series with the 47-pF capacitor. Adjust the pot until the meter barely reads with no signal input. Then measure with an ohmmeter and put in a fixed value as close to the measured value as possible. 10% tolerance is sufficient (52k was measured on the ICOM).

In the ICOM 4AT, the 47-pF capacitor was soldered to pin 5 of the i-f detector IC. In the Regency and the Standard, the capacitor was soldered to a similar point, i.e., the input of the 455-kHz ceramic filter.

Operation is quite simple. The three connectors, Ant., Spkr., and i-f, are plugged into the radio and the radio is set inside the paint can and secured by a rubber band or some such means to keep it from rattling around. Any suitable directional antenna is connected to the BNC jack on top, the 0–50-dB attenuator is set at 0, the sensitivity switch is set at "Max," and the hunt begins.

I have found during the several hunts I have used this system that after nearly a full-scale reading, the sensitivity switch can be set to "Min" for the rest of the hunt. Likewise, after the second near full-scale reading on "Min," the 50-dB attenuator can be switched in for the remainder of the hunt.

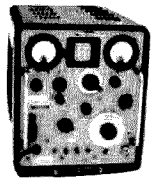
Between the rf shielding and the simplicity of operation, the system's effectiveness approaches that of pseudo-Doppler systems. Especially for stomping through fields. I have found I can get within 7 or 8 feet of a 1-Watt transmitter and the needle barely pegs at full attenuation.

For the experienced tinkerer or kit builder it is a two- or three-evening project. For the inexperienced or perfectionist, perhaps six or eight evenings. ■

Parts List

1	220-pF ceramic capacitor (optional)
1	10-pF ceramic capacitor
1	.04-uF ceramic capacitor
2	.01-uF ceramic capacitors
2	.1-uF tantalum capacitors, 10 V dc or more
1	22-uF tantalum capacitor, 12 V dc
2	1N914s
1	1k resistor, 1/4 Watt
1	2.2k resistor, 1/4 Watt
1	47k resistor, 1/4 Watt
1	6.8k resistor, 1/4 Watt
1	CA3089E (RCA or National)
1	2N2222 Transistor or equivalent
2	455-kHz i-f Transformers (yellow and/or white core from an old transistor radio)
1	Gallon paint can
1	50-mA meter movement
1	.001 feedthrough
2	47-Ohm resistors, 1/4 Watt
1	100-Ohm resistor, 1/4 Watt
1	330-Ohm resistor, 1/4 Watt
1	15k resistor, 1/4 Watt
1	Switch (3PDT)
2	Switches, push on/push off (SPDT)
1	12-V regulator and 2 9-V batteries, or
1	12-V Nickel-cadmium pack or gel cell

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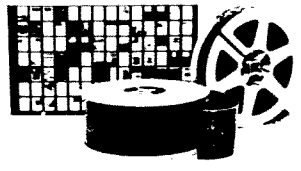
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What You See Is Where You're At: Part II

WA8YKN's universal digital frequency display stays on the mark no matter what your rig's mixing scheme.

I was pleased with the response to my article, "What You See Is Where You're At" (*73*, July 1985). There are now quite a few older general-coverage receivers sporting new digital frequency displays, and many of you took the time to write to me.

Most of these letters ended with something like, "I wish it was this easy to add a display to my (Kenwood, Yaesu, Heath, etc.)." After reading this recurring theme for the umpty-umpth time, I decided to design a Mark II version of the simple frequency display that, while retaining the simple programmable i-f offset feature, would be versatile enough to be used with *any* modern transceiver. The resulting display would be totally universal, yet simple enough to be attractive to the average home-brewer. "Universal" is a pretty strong word. It suggests the inclusion of the universe. I fully expect to hear from a reader on the fourth planet of Aldeveron with a Modulated Neutrino-Beam Transceiver. (No doubt the display would indicate quantum field intensity.) Let me say now that I do not have access to every rig ever designed, so there may be one somewhere that this frequency display won't cover. However, I can think of no mixing scheme to which this display cannot be adapted.

If you haven't read the article in the July issue, this is a good time to do so. This display is similar in construction and theory of operation, both of which were explained in detail in that article. That display was based on the 74196 programmable counter. The 74196 was selected for its speed, which is of top concern when tracking the low-powered vfo of a shortwave receiver over a 30-MHz range. Also, it is programmable, allowing a preset equal to the i-f frequency.

The 74196, however, will count only in the *up* direction, and as stated in the article, can be used only on receivers in which the vfo tunes in the same direction as the desired frequency. Virtually all single-conversion shortwave receivers, and even some amateur transceivers (such as the Argonaut) use this

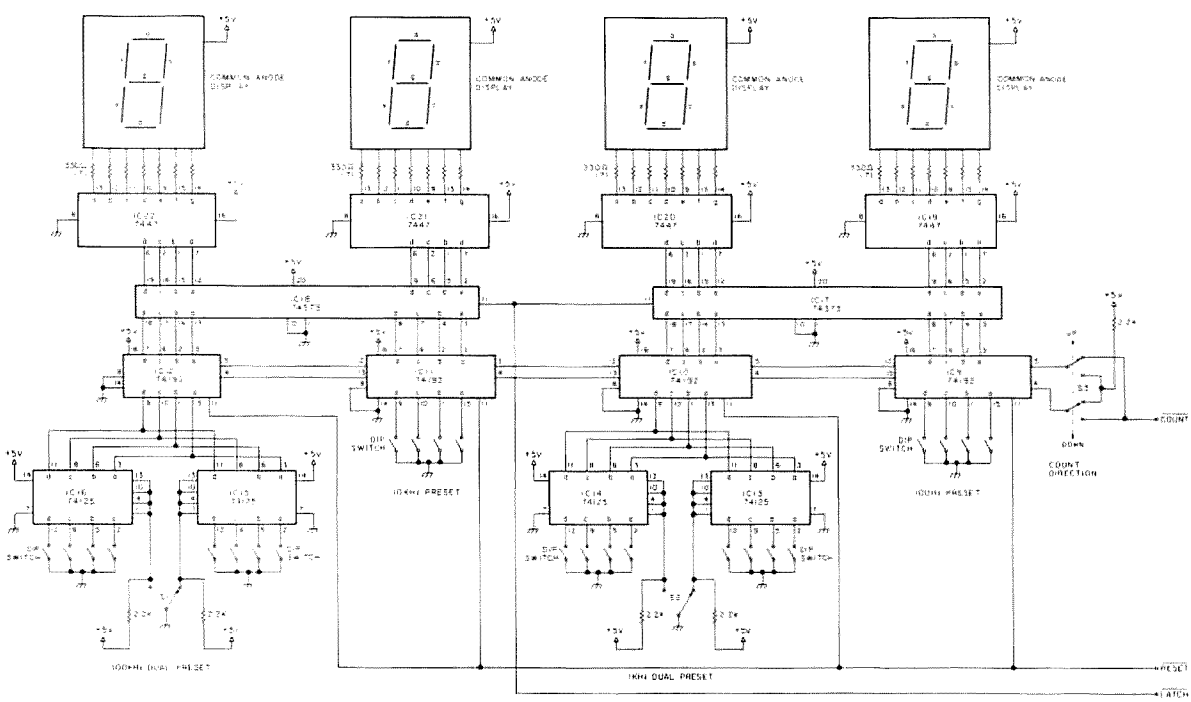


Fig. 1. Schematic of the "Frequency Display II."

scheme, and for these rigs the display works perfectly.

Many other transceivers use a multiple-conversion design in which the incoming signal is premixed using a crystal-controlled oscillator and mixer. The vfo always tunes over the same frequency range regardless of the band being used. And to complicate matters, the vfo usually tunes backwards. In fact, on some rigs the vfo will tune backwards on some bands and forward on others.

The vfo always starts with the same frequency, also, but our amateur bands do not. Some of them begin on X.000 MHz and some begin on X.500 MHz. Two offsets will therefore be required, just as most analog dials have two sets of markings. While we're at it, we should have a way to shift this offset by 3 kHz to allow for USB and LSB operation.

The design presented here overcomes all these problems. The 74192 counter is used, allowing both up and down counting. While not quite as fast as the 74196, it is adequate for our needs. The multiple preset for the 100-kHz and 1-kHz digits was accomplished through the use of 74125 tristate buffers, which select one of two sets of DIP switches for those digits.

For simplicity, only the digits to the right of the decimal point are displayed. There is no need to display the MHz digits, as we should be able to remember what *band* we're on!

At this point a problem surfaced. I don't own any equipment that uses this mixing scheme! I discussed this with John Farmer WA8GYP, who had been the first to evaluate the previous display. With only moderate arm twisting, John offered his Yaesu FT-101EE as a guinea pig.

This settled, I built the display in a few days, and the following weekend journeyed to far-off, exotic New London, Ohio, to try it out. The FT-101 series has the vfo frequency and 13.5 V dc available on the accessory jack, so no modification to the rig was required. Everything worked as planned, and John now has the only digital FT-101EE in New London. (The natives are suitably impressed.)

Circuit Details

Fig. 1 shows the count and display logic. The count input to the first 74192 is via S3, which selects either up- or down-counting modes. The Carry and Borrow outputs are connected to the up and down inputs of the next stage, and so on.

Resetting the counters by pulling pin 11 low loads the number present at the preset inputs, pins 15, 1, 10, and 9 (binary a, b, c, and d respectively). On the digits requiring only one preset, the number is set directly with DIP switches. Those digits requiring two presets use two sets of DIP switches, each isolated via a 74125 tristate buffer. Switching the enable lines low selects that preset. The other set of DIP switches (its buffer in the high-Z state) is ignored.

The latch and decoder logic operates exactly as in the earlier display. The 74373s happened to be on hand, and each one functions in this circuit just like *two* 7475 latches. This saves space and lowers the overall parts count.



Photo A. Why is this man smiling? See text!

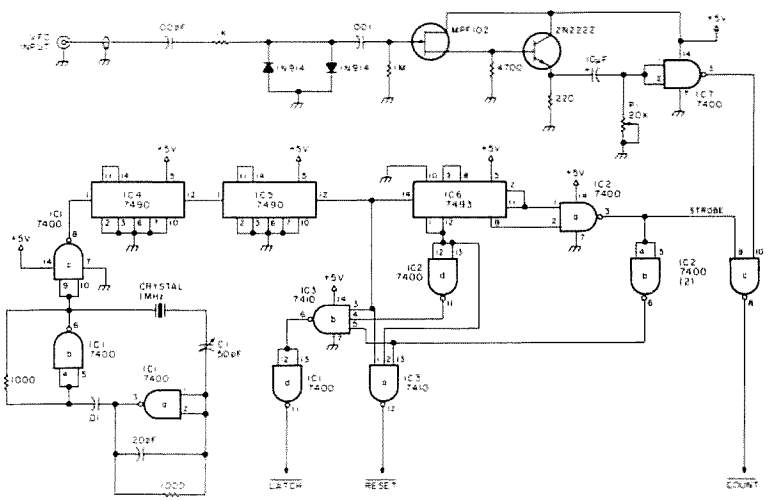


Fig. 2. Input and control logic.

Fig. 2 shows the timebase and control logic as well as the vfo-input circuit. The Count, Latch, and Reset signals connect to the appropriate inputs of Fig. 1. If you look closely at Photo B, you will notice a 5-MHz crystal and an extra 7490. At the time, I didn't have a 1-MHz crystal, so I used the 5-MHz one with a divide-by-five stage to produce the signal.

This worked for testing the operation of the display, but the old FT-243 crystal drifted quite a bit, so ultimately it was replaced with a quality 1-MHz crystal (soldered in place) and the extra divide-by-five circuit was disconnected.

Most modern transceivers have 12 volts available to power accessories, so the circuit of Fig. 3 uses an LM317 to reduce this voltage to the regulated 5 volts required by the display ICs. The 1000-Ohm pot (P2) is adjusted for 5.00 volts *before* the output is connected to the rest of the display. TTL ICs do not like overvoltage.

I recommend the use of LS (low-power Schottky) ICs over the standard TTL versions. Although functionally identical, the LS versions are slightly faster and draw only a fourth the current consumed by standard TTL ICs. This adds up to less drain on the power supply and considerably less heat buildup inside the cabinet, which is a big plus for stability.

When I built this display, the only 74192s I

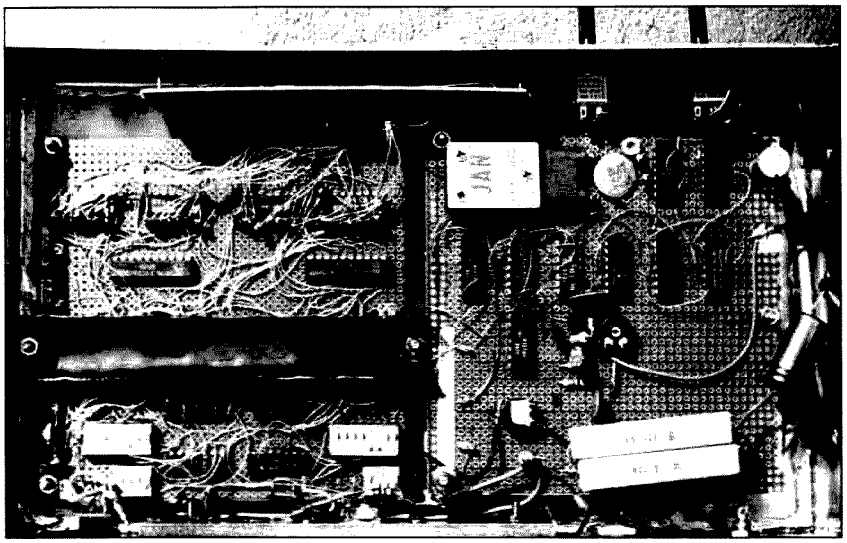


Photo B. Inside the frequency display. Plenty of room for everything. The heat sink for the regulator is mounted on the rear panel.

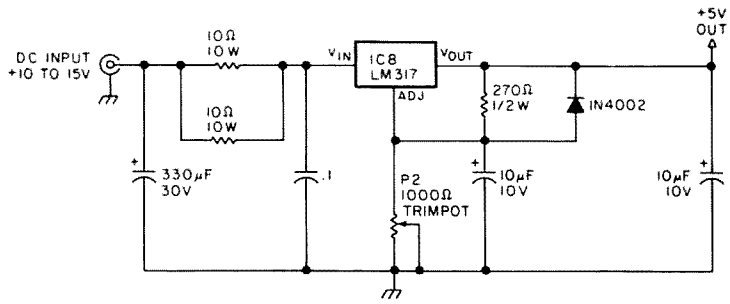


Fig. 3.

had on hand were some old high-power versions, and though they worked fine, they ran very warm. In fact, I ended up bending a strip of thin sheet aluminum to form a U-shaped heat sink, which I bolted down across the entire row of counters. A dab of white silicone grease on each IC carried the heat away, but the use of 74LS192 counters would eliminate the need for such measures.

No pinout is given or the common-anode displays since that varies with size and manufacture. If you purchase the seven-segment displays new, they will have pinout information with them. If you use surplus "bargain-pack" assortments (like I do), it is a simple matter to determine which pin goes where.

The anode usually is connected to several pins, easily found with an ohmmeter. A few minutes with a dc source, a current-limiting resistor, and two clip leads will identify the rest. A $1.98 bargain pack produced three large (.7") displays in which all segments worked, and a smaller (.3") one which I used as the 100-Hz digit.

Construction

I built the frequency display on two five-inch square pieces of perforated Bakelite™, one piece for the timebase and the other for the count and display logic. Connections were made point to point, using Radio Shack wire-wrap wire. Layout is not particularly critical (see Photo B for details).

The enclosure was made up from copper-clad circuit-board material soldered at the seams. I bolted a ¼" thick strip of aluminum to the rear of the enclosure to act as a heat sink for the LM317 voltage regulator, and the opening for the display was cut with a Radio Shack nibbler.

The displays were mounted on a small scrap of perfboard mounted directly behind the opening. I used red-tinted plastic as a light filter. The blank leader from developed 35-mm color negatives also works well here.

The location of the three switches will depend on the mixing scheme of your transceiver. In the case of the FT-101, the vfo always runs in the backwards direction, so the up-down switch, S3, was mounted on the rear. (It could be eliminated if you have only one application in mind.)

S1 and S2, which select the display offsets, were mounted on the front panel to the left of the readout. A piece of ⅛-inch-sheet aluminum and two scrap angle braces bolted together form the lid. Be sure to drill plenty of ventilation holes over the regulator and the 10-Ohm resistors to let the heat escape.

After painting, the switches can be identified with Radio Shack rub-on lettering. The completed display measures 11" wide by 2" high and 6" deep and is quite attractive with the FT-101 (see Photo C).

Setup and Operation

The timebase oscillator must be adjusted carefully to 1 MHz if the display is to be accurate. Either a good frequency counter or a receiver set to WWV can be used, adjusting C1, the 50-pF trimmer capacitor, for zero beat. An oscilloscope triggered on the Strobe signal (IC 2, pin 3) should display the timing waveforms shown in Fig. 4.

With the display operating but not connected to the transceiver, the DIP switches can be checked out for proper operation. With all the switches closed, all digits will read zero. Opening one of the four switches for a particular digit will cause the value of that switch to be displayed. For example, opening switch a on the 100-Hz digit will cause that digit to display 1; switches b, c, and d will similarly display 2, 4, and 8.

Opening more than one switch adds the values. To display 3, for example, open switches a and b. Opening all four switches will cause that digit to go blank. This isn't a fault with the display, it's just that all four switches add up to fifteen, and that's why the 7447 decodes binary 1111.

The digits with two presets are checked out in the same way, but each set of switches can be displayed only when selected by S1 or S2.

If everything checks out, it's time to hook the vfo signal to the input. Most transceivers have a vfo input available at the rear panel, so take a look at your manual. If it's necessary to provide your own tap, find the output of the vfo buffer and you'll see a capacitor coupling the vfo signal to the mixer. That's the point you want. Tap in with a 100-pF capacitor and bring the signal to the rear panel using small coax.

The input-gate bias is set by slowly adjusting the 20k trimpot, P1. Somewhere around the middle of its range, the display will start counting the vfo. In fact, with all the DIP switches closed and S3 in the up-count position, we now have a four-digit frequency counter reading out the last four digits of the vfo frequency.

On John's FT-101, the vfo tunes from 9.200 MHz at the low end of each band to 8.700 MHz at the high end. The display reads .2000 to .7000, counting backwards. By switching S3 to the down-count position, the display will read .8000 to .3000, and will now be counting in the proper direction.

Setting the DIP-switch presets is simple. Start with 80 meters. Set S1 to the X.500 position and set the transceiver to 3.500 MHz. With the FT-101, the display will read .8000. Adding 7 to the 100-kHz digit will cause it to read (1).5000—just what we want—so open DIP switches a, b, and c. The display will now agree with the dial.

Next, try 40 meters, setting S1 to the X.000 position. This selects the other set of DIP switches for the 100-kHz digit. Tune the dial to 7.000 MHz and, on the FT-101, the display will again read .8000. This time we need

to add 2 to the left-most digit to cause it to read (1).0000, so DIP switch b is opened.

The USB-LSB switch, S2, is handled in the same manner. Set the transceiver on upper sideband and zero-beat a signal. Set switch S2 in the USB position and note the frequency displayed. Now switch the transceiver to lower sideband and again zero-beat the same signal. Set S2 in the LSB position and note that the display is reading low by 3 kHz. Adding .0030 to the count will fix it, so open switches a and b on the DIP switches currently active for the 1-kHz digit.

With the display now properly set up, using it is simple. 160 meters, 80 meters, and two segments of 10 meters require S1 to be set in the X.500 position; 40, 20, 15 and the rest of 10 meters require S1 to be in the X.000 position. Also, switch S2 must be set to agree with the mode of operation.

Adapting to Other Transceivers

Although the FT-101 was used in the previous example, any transceiver with a backwards-tuning vfo will require exactly the same procedure to determine the presets required and program the display. Any transceiver in which the vfo tunes forward on some bands and backward on others still will require two presets on the 100-kHz digit, since the displayed count will change when switching from up- to down-counting modes, but it should be possible to use a DPDT combining S1 and S3 into a single control. In this manner, the operation of the display with such a transceiver would be identical to that with the FT-101.

If your vfo always tunes in the forward direction, you probably would be happier building the 74196 version I presented in the July issue. This one will do it, but the extra complexity is unnecessary.

Accuracy

There is only one oscillator in a single conversion superhet, the vfo. It is always removed from the received frequency by exactly the i-f frequency—no more and no less. But in a modern transceiver using a premix oscillator and a bfo in addition to the vfo, there exists the potential for error.

Commercial frequency displays get around this by counting *all* the oscillators and displaying the sum. This type of circuit, however, is pretty complex for a home-brew project. By counting the one that tunes and presetting the counters to make up for the rest, a much simpler display results, one that is not only practical and low-cost but easy to understand and build.

How much of a trade-off is this? Let's consider. We've got the bfo covered with two presets available for USB and LSB, so even if these oscillators are slightly off, we can compensate with the DIP switches. We're *counting* the vfo, so there's *no* chance of error there. So the only possible source of inaccuracy is the premix oscillator.

If we set our DIP switches for one band, there's a chance that the crystal for another band may be a little high or low, causing the display to be in error. However, if we assume

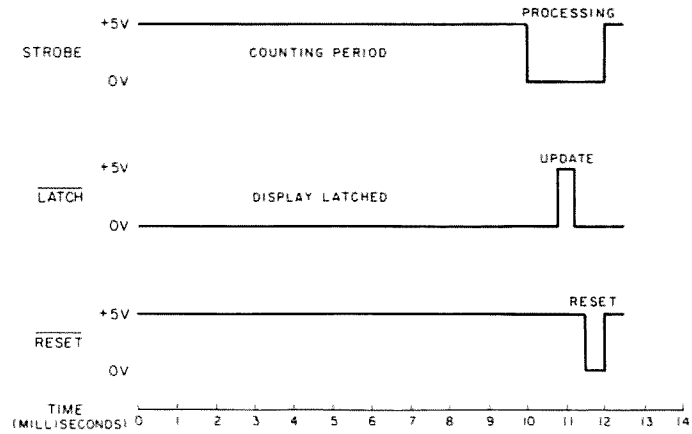


Fig. 4. Control timing.

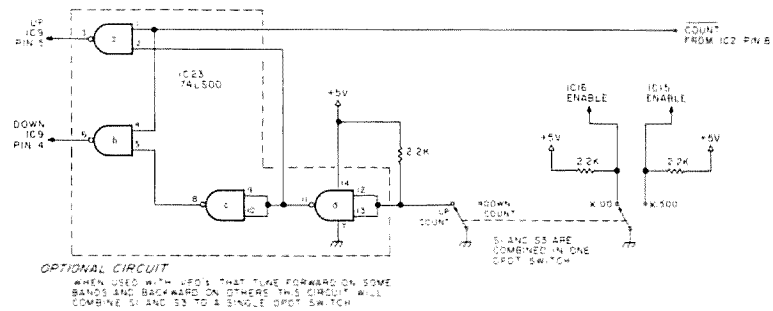


Fig. 5. Optional circuit.

that the manufacturer of the transceiver used reasonable care in designing and building his product, the error should be small. On John's FT-101EE, all bands were accurate to within 100 Hz except the 160-meter band and the 29.500 segment of 10 meters. Both of these were 200 Hz off.

Although this does represent a small error, this does *not* mean that the tuning is in any way ambiguous. The error does not change, and if John must know his *exact* frequency, he has only to subtract 200 Hz on these two bands. The resolution is there, and it is still possible to return within 100 Hz to any frequency.

Also to be considered is cost. A commercial display using the oscillator-summing method will set you back $200–$250. By settling for a small potential for error, we save a couple hundred bucks! Did WA8GYP



Photo C. Shown here with the Yaesu FT-101EE, this version of the simple frequency display can be used on any analog transceiver.

consider it a fair trade? Look at Photo A, and note the big smile on John's face! This display will cost around $40 purchasing all parts new. If you have a typical home-brewer's junk box, it can be done for much less.

Final Thoughts

The potential is here to add a simple, low-cost frequency display to just about anything. A little time with the manual of a particular piece of gear should give you a clear idea what will be required, and you can modify my basic layout to suit your individual needs. The display can also be tailored to your operating habits.

For example, I usually operate RTTY and CW. My only phone activity is an occasional contact on 75 meters. Since I never use USB, that preset could be used to make up for the 2125-Hz error on RTTY caused by feeding audio tones into the transmitter (AFSK). The display would then show my actual mark frequency! Get the idea? There's a lot of room for originality here.

Home-brew projects are fun and educational. It's an amateur tradition. And when your buddy sees those beautiful red-glowing digits you can say, "Yeah, I built that last week." That, my friends, is a feeling I cannot put into words.

I would enjoy hearing from anyone interested in this project, and will try to help with any specific questions. Please include an SASE, however. ■

Parts List

Integrated Circuits

1, 2, 7	7400
3	7410
4, 5	7490
6	7493
8	LM317
9, 10, 11, 12	74192
13, 14, 15, 16	74125
17, 18	74373
19, 20, 21, 22	7447

Displays
7-segment LED, common anode, 4 required

Capacitors
Ceramic discs, one each: 20 pF, 100 pF, .001 uF, .01 uF; electrolytic: (3) 10 uF, 10 volt, (1) 330 uF, 30 volt

Resistors
(28) 330 Ohm, (5) 2.2k Ohm, (3) 1k Ohm, (1) 4700 Ohm, (1) 1 megohm, (1) 220 Ohm, (2) 10 Ohm, 10 Watt, (1) 270 Ohm, 1/2 Watt; trimpots: (P1) 20k Ohm, (P2) 1k Ohm

Transistors
(1) 2N222, (1) MPF102

Diodes
(2) 1N914, (1) 1N4002

Switches
(S1, S2) SPDT miniature toggle switches, (S3) DPDT miniature toggle switch, (6) 4-pole DIP switches

Misc.
(1) 1-MHz crystal, (1) RCA jack, (1) #SO-239 coax jack, perfboard, wire, solder, cabinet materials, etc.

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PL259TS		PL259 Teflon/Silver		1.59
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UG175		Adapter for RG58		.22

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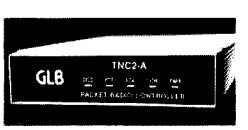
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Total Solar

Plug your shack into the sun! Here are complete plans for energy independence.

Photovoltaic electricity is rapidly becoming the technology of choice for powering amateur radio stations. With the price of photovoltaic panels falling, large arrays are now within the range most hams can afford.

To make the most efficient use of the available energy, a photovoltaic controller will be needed. If the solar array were to be left connected to the batteries all the time, severe overcharging would occur, resulting in excessive electrolyte gassing and unnecessary loss of electrolyte. Physical damage also can result in the form of warped plates and the dislocation of the plate's lead paste. Likewise, in times of low periods of sunlight, the batteries could become damaged by deep-discharging.

The controller described below will allow the direct charging of lead-acid batteries without the need of a blocking diode (in the direct-charge mode). It also will provide a low-state-of-charge warning system. When the batteries become fully charged, a second, floating charge system will keep them topped up and ready to go. Energy-load management can also be installed.

Charging Techniques

The techniques by which batteries are charged via photovoltaics have been and still are varied. However, two basic technologies are used: shunt mode and direct (switching) mode.

In the shunt mode, array power is diverted from the batteries by shunting power to ground on the array side of a blocking diode. The battery-terminal voltage is monitored, and by a feedback loop to the controller, excess power is diverted. This excess energy is dissipated as heat, usually by resistors.

With the direct mode, a relay or transistor switch is in series between the array and the batteries. As charging progresses, the battery-terminal voltage will rise. It is then possible to approximate battery state-of-charge to this terminal voltage. By monitoring the battery-terminal voltage, the controller can decide when to stop current flow and may do so by opening the relay or turning off the switching transistor.

While the shunt-mode controller can operate with no moving parts, the heat built up by the resistors has to be removed. This calls for a large bulky unit. Likewise, if the switching controller uses a relay, we now have one moving part that may go bad in time. The use of a transistor switch will get by that problem. However, the transistor must now be able to pass the total current of the array. Careful heat-sinking will be required. There is also the voltage drop across the transistor junction that will reduce efficiency.

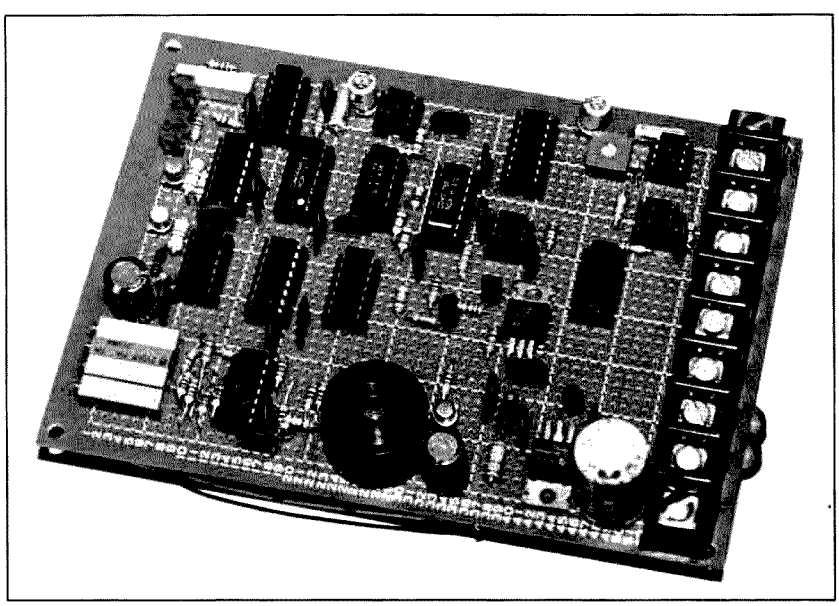


Photo A. The complete control logic. Some minor changes were made to the circuit after the photograph was taken.

A Better Controller

Look at Fig. 1. The basic circuit for the controller makes use of the LM339 voltage comparator. This chip provides an output that is at a high state when the inverting input is below the reference voltage. When the voltage on the inverting input is equal to or greater than the reference voltage, the output switches to a logic low.

The reference voltage comes from the power-supply circuit. A 78L05 provides a constant 5 volts for the comparators while a 7805 regulator was wired to provide 10 volts for the remaining logic. The usual bypassing was done so the circuit logic can be used around rf fields.

To set up a "voltage window," comparators A and B connect first to a 4050 noninverting hex buffer. From there, the output of the buffers connect to a NAND gate of a

4011. The other two gates make up an R/S latch. When the battery voltage drops below the "reset" window, a logic 0 is applied to set the latch. The output of the R/S latch will go to logic 1 and into the 4082.

The output will stay this way until the battery voltage rises above the float-charge level. At that time comparator A will go low, resetting the latch and turning off the output. An inverting buffer, a 4049, will then turn on transistor Q1 and light the float-charge LED.

Comparator C is wired as the first two, but instead of monitoring the battery voltage, its job is to look at the array voltage. If the array voltage is above 10.5 volts, the output will remain a logic 0. A second gate of the inverting buffer provides the proper logic sense for the 4082.

The comparator will not be able to do its job, however, because the relay will be closed. This will fool the comparator into believing the battery voltage is the same as the array voltage. To get around this, some means of opening the relay contacts is needed so the comparator can "see" the array voltage. The relay must then close to continue charging. This is where the 4082 and the clock circuit come into play.

The clock that I had planned originally used a color-burst crystal and an MM5369 17-stage divider. However, to slow the clock

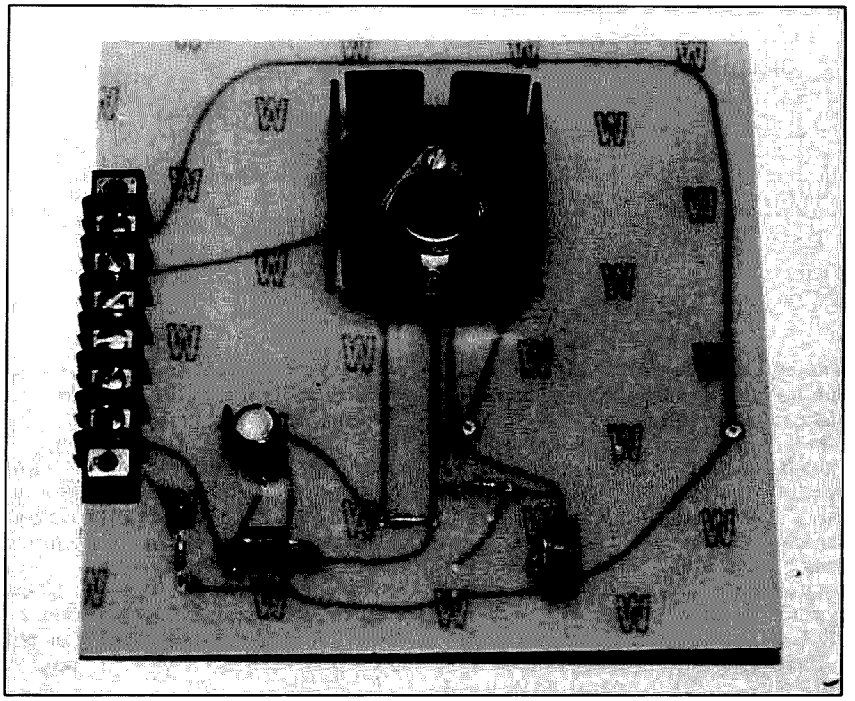


Photo B. The float regulator board. Since the circuit is simple, a PC board was made using rub-on resist. Note heat sink on the LM317K.

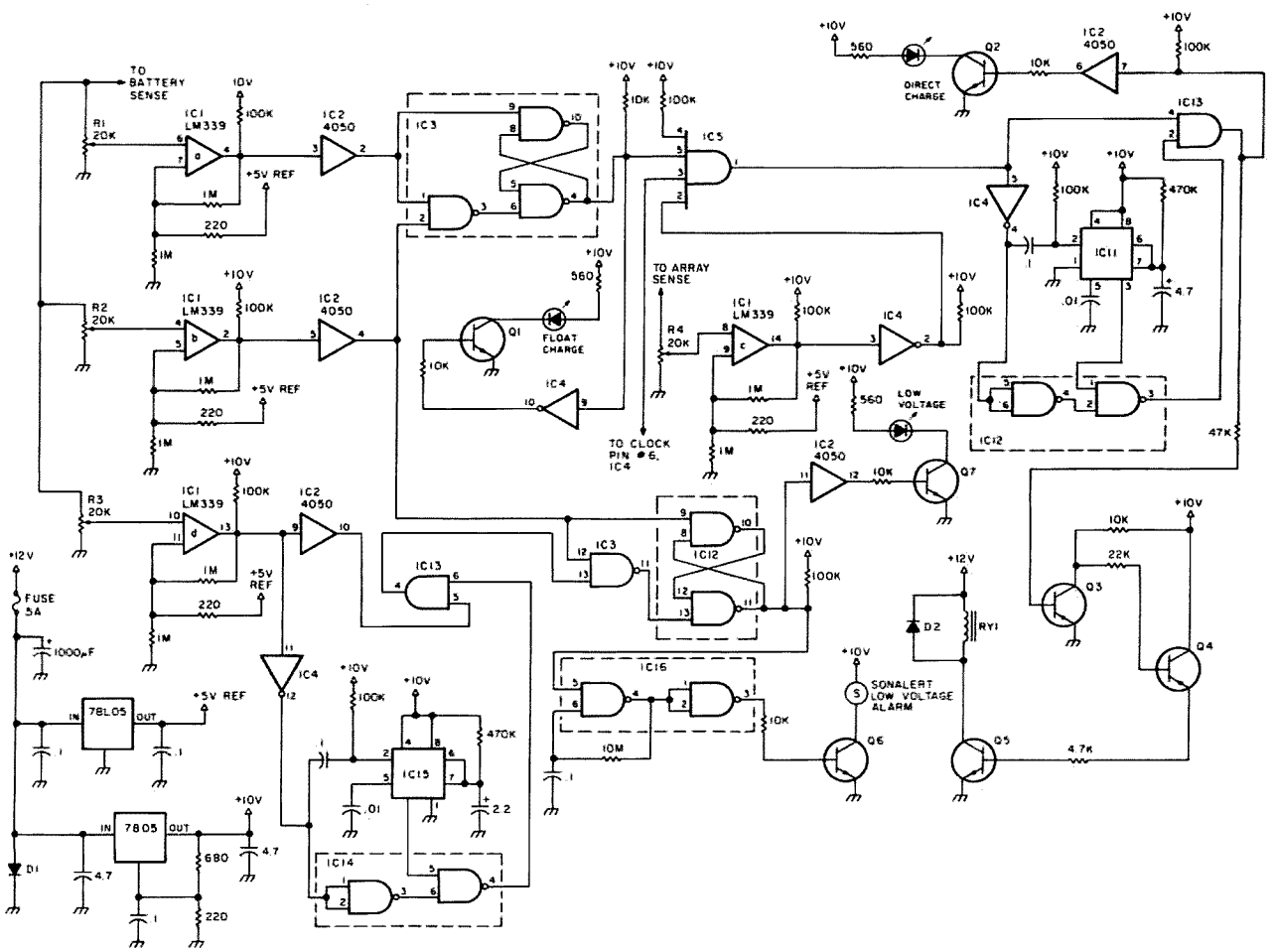


Fig. 1. Schematic diagram.

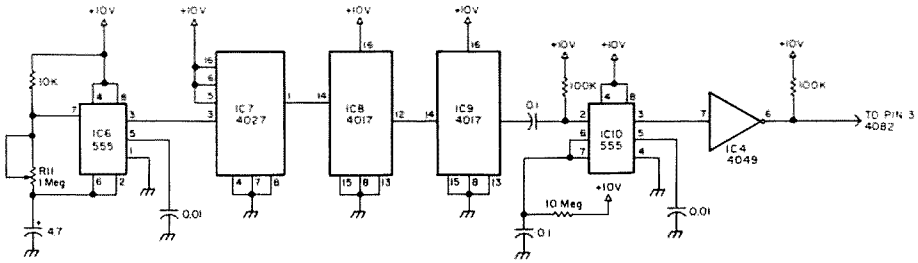


Fig. 2. Clock circuit.

down to the time I needed required the use of either a large divide-by chain or expensive and hard-to-find components.

In the early stages of design, I used the clock shown in Fig. 2. It worked so well that I decided to stay with it. The 555 timer is wired as an astable oscillator. Resistor R11 and capacitor C10 control the frequency. By adding a clocked flip-flop to the timer's output that acts as a binary divider, a perfectly symmetrical square wave is available for the divide-by chain. A 4027 does the job nicely.

The square wave is then connected to a 4017 divide-by-10. A second divide-by-10 slows the clock pulses down to a usable period. The output of the last 4017 is connected to a second 555 timer, wired as a one-shot.

Again, resistor R12 and capacitor C11 set the time. The output is inverted by the 4049 and held to a logic 1 by the 100k resistor. The output then goes to pin 3 of the 4082. Depending on the setting of the trimmer control of R11, there will be a high-to-low pulse, returning to logic 1, on pin 6 of IC4 every 2 minutes to every 90 minutes.

With the "window comparators" and the array comparator all at a logic 1, the clock also will be at a logic 1. The remaining pin of the 4082, pin 4, is held at logic 1 by the 100k pull-up resistor. That pin will be reserved for future use.

Since the 4082 is an AND gate, all inputs must be at logic 1 for the output to be logic 1. If either the R/S latch goes off, the array voltage drops, or the clock pulses, then the output of the 4082 will go to logic 0. This is how the array comparator can "look" at the array. When the clock goes low, the output goes low, turning off the relay.

If the array voltage is above 10.5 V, then the output of the array comparator stays low (logic 0). (Of course, that is being inverted by the 4049 so the 4082 will see a logic 1.) If the voltage is lower than 10.5 V, the output of the comparator will switch logic and the 4082 will keep the relay off. The same thing will happen when the battery becomes fully charged. The float voltage of 14.5 volts will turn off the latch and the 4082 will lose one of its inputs. It, in turn, will shut off the relay. This will prevent overcharging of the battery.

The clock pulse at the end of the divide chain is just that, a pulse. The relay must open and the contacts must stop bouncing. At that time, the array comparator can decide the status of the photovoltaic panels. To do just that, a pulse-delaying circuit was needed.

". . . the thrill I get from communicating around the world with solar energy is beyond words."

When the output of the 4082 goes to a logic 1, pin 1 of the 4081 is held to a logic 1. Pin 2 of the 4081 goes to the pulse-delay circuit. When pin 1 of the 4082 goes to logic 1, it is inverted by a 4049. This starts timer IC11. The output of this timer stops the flow of logic until it times out—in this case, about 3 seconds.

When that time is up, the logic 1 is now allowed to go to pin 2 of the 4081. With both pins now at logic 1, the output of that chip also goes to logic 1. The output goes two places. First, it turns on Q2, the "direct charge" LED, via a 4050 buffer. Next, it turns on the transistor switching needed to operate the relay. The TIP 29 transistor will handle about 1 Ampere of coil current.

If the battery voltage rises to the float setting of 14.5 volts, the relay will open. When it does, the float-regulator circuit will take over and maintain the battery in a float condition. The float current will depend upon the condition of the batteries and the amount of photovoltaic energy. The float-regulator circuit is connected across the relay contacts of the main relay. When the clock times out and the relay opens for the array check, there is little or no contact burning.

Fig. 3 shows the float-regulator circuit. As can be seen, an LM317 is used in a conventional power-supply configuration. I had to place a diode in series with the output of the regulator chip because the regulator sometimes would not start up—perhaps because of the battery voltage on the output of the regulator.

With this diode in place, there is no trouble with the regulator operating as it should. Trimmer pot R1 sets the voltage of the regulator. It can be used to adjust the current flow of the regulator when in the float-charge mode. Its adjustment is not critical. The LM317 requires a heavy sink to pass the maximum 2 Amps of current.

To keep from discharging the battery bank too deeply, a low-voltage warning system was installed. It operates almost exactly like the circuit used to monitor the full-charge float system. The last comparator of the LM339 is used to monitor the low-voltage point of 11.7 volts.

To keep the warning system from turning on and off with a load, the pulse-delaying circuit is used. If it was not connected, then the warning tone would follow the CW as the transmitter would load down the batteries. A rather exotic sidetone generator! This also allows a high-current turn-on load to be ignored (such as a power inverter or motor).

Also, when the batteries become low, I wanted the warning to sound until they were almost recharged. If not, a dead battery bank would shut off the warning when the next day came and the panels starting charging the bank.

When the battery voltage dips to 11.7 volts, pin 12 of IC4 goes low. This trips the time-delay of 2 seconds. At that same time, the comparator's output is applied to one side of

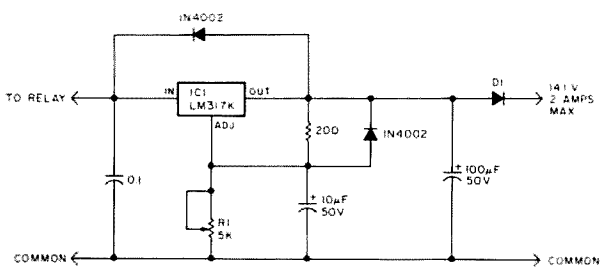


Fig. 3. Float-regulator circuit.

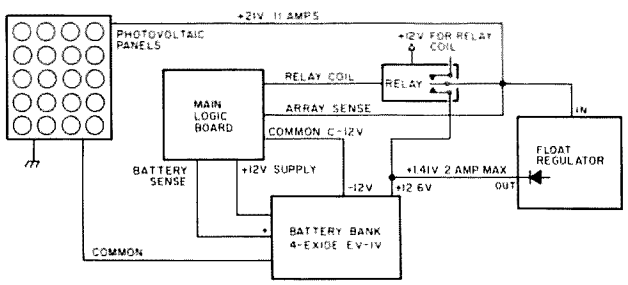


Fig. 4. System diagram.

an AND gate, IC13. When the 555 timer times out, the other half of the AND gate gets a high logic. With the reset comparator (B) high, the R/S latch is set. This turns on the gated oscillator which drives a piezo-electric sounder. The latch also drives Q7 on via the buffer gate and turns on the low-voltage LED.

When the voltage reaches the reset point of 12.5 volts, the R/S latch is turned off. It should be noted that the reset voltage and the reset window voltage will be the same. I didn't want to use another comparator.

With the proper transistor switching, a relay could be placed in use as a low-voltage disconnect. A remote solar-powered repeater could be wired to disconnect the power amplifier when the battery bank is low. Then reconnect the amplifier when the batteries become 60% charged.

Operation

In normal use, the controller logic will work as follows. Assume full array power and a 90% charged battery bank. At sunrise, the array voltage will rise above 10.5 volts. Since the battery voltage is below the reset point of 12.5 volts, the relay is turned on and full array current is allowed to flow into the batteries.

Every hour the clock will time out and cause the relay to open up. The array comparator will look to make sure the array is still 10.5 volts. It is—and the relay will again close. As the batteries increase their charge, the terminal voltage will rise. When it comes up to the float-set voltage of 14.5 volts, the relay will drop out. The float regulator will now supply a maximum of 2 Amps to the battery bank. This current will fall back to about 500 mA to 1 Ampere.

If a load is applied to the batteries, the float regulator will try to supply the maximum current of 2 Amperes. If the load is great enough, the battery-terminal voltage will fall to the reset point of 12.5 volts and again the relay will be turned on and full array current will be applied.

Every hour the array voltage will be checked. When sunset arrives, the array voltage will begin to drop. When it goes below 10.5 volts, the array comparator will tell the logic to shut off the main relay. The system will then wait until the next morning, when the whole process repeats itself.

As can be seen, the relay will remain closed as long as the batteries need charging. This can be used as a cheap and dirty load-management system. By connecting the load through a second set of contacts on the relay, only when the batteries are fully charged will the load be connected. Of course, only nonessential loads should be done this way.

Putting It Together

Construction is best done on perfboard. As there are several options, no printed circuit was designed. One may not wish to install the low-voltage system. That choice is up to the builder.

Since the controller uses CMOS devices, some care should be used in their handling.

Parts List—Main Logic

R1, R2, R3, R4	20k Ten-turn trimmers
IC1	LM339 Quad comparator
IC2	4050 Hex buffer
IC3, IC12, IC14	4011 Quad NAND gate
IC4	4049 Inverting buffer
IC5	4082 4-Input AND gate
IC6, IC10, IC15, IC11	555 Timers
IC7	4027 Flip-flop
IC8, IC9	4017 Decade counters
IC13	4081 Quad AND gate
IC16	4093 Schmitt trigger
Q1, Q2, Q3, Q6, Q7	2N2222A
Q4	2N2907
Q5	TIP 29
78L05	
7805	
C1	1000 uF @ 25 volts
D1	1N4003
D2	1N4002
RLY	12-Volt coil, 10-Amp contacts, DPDT
R11	PC mount, 1-meg trimmer
SY1	Piezo-electronic sounder
Regulator Board	
IC1	LM317K Regulator
R1	5k PC-Mount pot
D1	3-Amp Diode (use RS/276-1144 for 3 Amp)
	Heat sink for regulator

Try to avoid static since this will damage the chips. Also, there are some unused gates. The input pins should not be left floating. They must go somewhere! Either tie the pins to Vcc or to ground. (Not shown on the schematics, .1-uF capacitors are placed at all Vcc pins of the chips.)

There is nothing about the controller logic that is carved in stone. Feel free to change or to delete parts of the logic not needed.

The circuit could be wired for different types of ICs. The 4011 chips that I used for an R/S latch can be replaced with a 4044 quad latch. Likewise, the 555 timers can be replaced with a 4528B. Of course, that is one reason no PC was done. In fact, all the 555 timers needed could be replaced with one quad 555 timer, the 558. The rest of the parts are very common.

There are only two components that should not be substituted: the main relay and the 10-turn trimmer that set up the comparator. The relay I use here is surplus and was picked up at a local flea market. The contact rating is 25 Amperes. The relay must be able to handle the total current of the array.

The best way to build the controller is in modules. Photo A shows the finished logic board. This way, parts of the circuit can be tested before moving on to the next stage. The modules can be placed in groups on the single perfboard. The main modules are: comparators, power supply, reference supply, pulse-delaying circuit, and output circuit. The low-voltage warning system would be installed last.

Calibration

To set up the controller, you will need a digital voltmeter, a VOM or logic probe, and a variable power supply.

While the low-voltage warning system will be adjusted last, it may or may not sound. To keep it from going off until needed, pull the 4093 from its socket. Replace it when setting the warning system.

Apply 12 volts to the circuit. Check that +5 volts at the output of the 78L05 is there. Also check for +10 volts at the output of the 7805. Temporarily connect the battery-sense voltage to the power supply. Reading the voltage from the digital meter, set the supply at 12.5 volts. Monitor pin 2 of the LM339 and adjust trimmer R2 until the logic switches from high to low. Rock the supply about and make sure that pin 2 goes low at 12.5 volts.

To set the float point, adjust the supply to read 14.5 volts. Monitor pin 1 of the LM339. Adjust trimmer R1 until the logic goes low (logic 0). Assuming that the rest of the circuit was wired correctly, the float-charge LED should light when the voltage is over 14.5 volts.

The next comparator will be the array comparator. Connect a wire temporarily to the "panel sense" and adjust the supply to read 10.5 volts. Monitor pin 2 of the 4049. Adjust trimmer R4 until the logic goes low. Increase the voltage and pin 2 should go to a logic 1.

The last comparator will be the low-voltage warning. Set the supply for 11.7 volts and adjust trimmer R3 until pin 12 of IC4 goes low. Increasing the voltage should make the logic switch low. At this point, the alarm should sound.

All the voltage set points should be adjusted

more than one time. You want the logic to switch at the required setting.

Remove all the jumpers and disconnect the power supply. The controller can now be placed in use. I used industrial conduit boxes to house the circuit boards. Since I use both solar and wind power to operate the station, both control systems are located together.

Troubleshooting

If something is not working, then help may be had at the test points. Make sure that the 555 oscillator is running in the clock. Look at pin 3. By following the pulse through the divide-by chain, any problems will be uncovered. Pin 1 of the 4082 must be logic 1 (high) for the relay to close. If it is and the relay is not closed, check for trouble in the pulse-delaying circuit or the output switching. If the wiring is fine, then start looking for bad chips. Use sockets.

Before the controller is put into use, some information about batteries may be helpful. There are two basic types of lead-acid batteries on the market, the lead-antimony and the lead-calcium. As the name implies, the lead-antimony battery contains lead alloyed with antimony while the calcium battery is composed of lead alloyed with calcium. Both batteries have voltage outputs of about 2 volts per cell.

The lead-antimony battery must now and then have its cells equalized. This is done by slightly overcharging the battery until all cells read the same specific gravity. The cells use up a greater amount of water than the calcium battery. In fact, most of the so-called "sealed automobile batteries" are lead-calcium. The lead-calcium battery is less likely to sulfate. However, the lead-antimony battery has a much better life cycle and, because you can check the cells for specific gravity, much data may be obtained on battery condition.

Caveat

There is a fact that should be noted. The amount of recharge current should be adjusted to the amount of storage. In other words, don't try to recharge 500-Ah batteries with only 1.5 Amps of solar energy. While it will in fact get the job done, the controller will not be needed. With array current under 35 Watts, no controller would be needed—just a diode to prevent discharging at night.

On the other hand, don't try to charge up a motorcycle battery with 14 Amps of current. The controller will be fooled by the charge rate and stop the direct-charge rate too soon. The bottom line is to size your battery capacity to match your charging current.

All of the voltages listed here were found to be correct for my station's batteries and solar array. The main thing to remember is that the batteries are not fully charged when they reach 13.8 volts. We have to put more back into them than we take out. That is why the float voltage is 14.5 volts.

At night, with a small load on, the "surface charge" will be removed and the true standing voltage will be at the terminals. This will be about 12.6 volts, depending on the temperature of the electrolyte. My solar array will put into the batteries (on a cool bright day) about 11 Amps. When the batteries just start to gas, the terminal voltage is 14 volts. When the voltage hits 14.5 and the controller switches over, the specific gravity reads 1.280.

Total Solar

Fig. 4 shows the hookup into the system. Note that the battery voltage-sense wire goes directly to the battery. Don't cheat and take it off the controller supply feed. The array sense must go to the array side of the relay contact. The float regulator connects across the relay as shown.

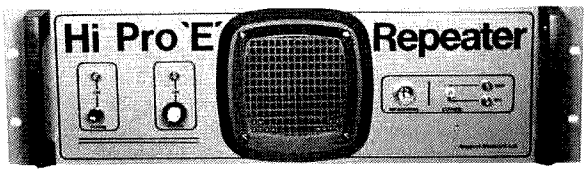
That will finish this project. If you use the controller as a building block, expanding the system will be much simpler. A master-slave control unit would be next. To make equalizing the battery bank easier, an SPDT switch may be placed in the battery-sense line. This would select the actual battery voltage or a predefined set voltage. That way, the battery will get an overcharge and equalize its cells. A limited overcharge will be good for the batteries every now and then.

No matter how many times I watch the ammeter move up and down, the thrill I get from communicating around the world with solar energy is still beyond words. Perhaps you, too, will give it a try, now that you know how to control the power of the sun! ■

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• AN EXTENSION PANEL IS AVAILABLE FOR LOCAL MONITORING OF THE REPEATER AND CONTAINS ALL NECESSARY METERING, STATUS LIGHTS AND INDICATORS. ALL ADD ONS ARE AVAILABLE FROM THE COMPANY AND ARE COMPLETE INCLUDING INSTRUCTIONS. THE Hi Pro "E" IS AVAILABLE IN NOVEMBER.

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Agc, PDQ

Take the cotton out of your ears—add automatic gain control to your Century/21.

It's happened to all of us: You're using a no-frills receiver, probably direct conversion, and you've got the gain all the way up trying to copy that weak one down in the noise, and all of a sudden—screech! A local has come on and nearly melted the headphones before you can crank the gain back down.

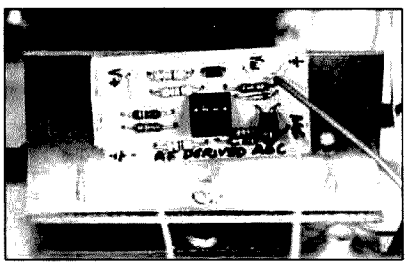


Photo A. PDQ agc circuit.

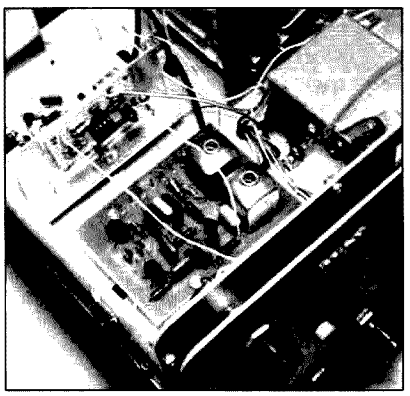


Photo B. PDQ circuit installed in a Century/21.

Well, before you throw your hands up in disgust and condemn the ol' rig to exile on the closet shelf, have a look here. All that radio needs is a little agc—and this simple circuit just may be the ticket!

Agc stands for automatic gain control, and it is just that: a feature in a receiver that automatically adjusts the gain of the receiver to keep the audio output at a fairly constant level over a wide range of signal strengths. In other words, for very weak signals the gain is adjusted higher, increasing the audio level; for strong signals, the gain is adjusted lower, decreasing the audio level.

Many of the less expensive receivers or transceivers on the market lack an agc feature, particularly the QRP radios. The Ten-Tec Century/21 is typical. I designed the "PDQ Circuit" for use in my Century/21, but with a little modification it can be used with other radios having similar configurations. It is easily built, requires very little modification to the receiver, and is simple to remove should you ever decide to restore your radio to its original condition.

Principle of Operation

There are several ways to achieve automatic gain control in a receiver. They all give the same general results, but some provide better performance than others. The strength of the signal is sampled after the filter stage

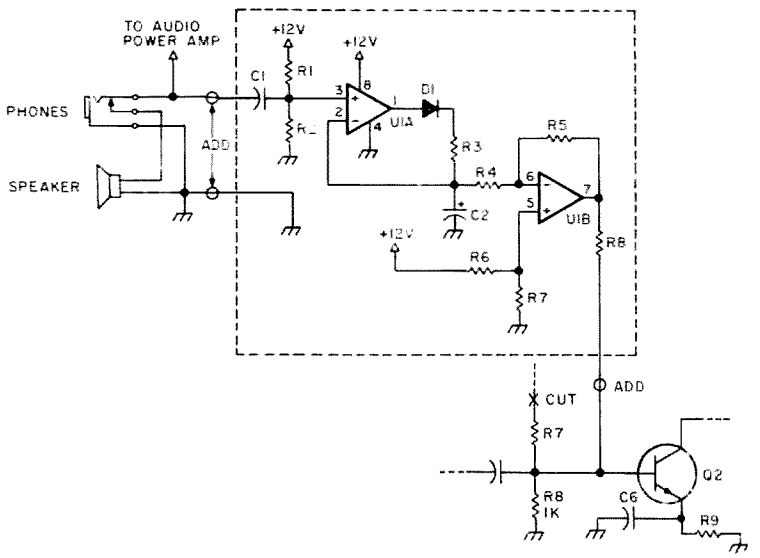


Fig. 1. Agc schematic.

Joe Roeder WB0WPY
2021 N.W. 65th #4
Seattle WA 93107

Radio to Go

If you can't bear to be parted from your rig, strap on WB0WPY's VOX headset.

The term "ham radio operator" usually conjures up the image of a man sitting in some remote corner of his basement surrounded by racks of glowing equipment, puffing on his pipe while talking to some far-off exotic land, the gentle buzz of 60 cycles oozing out of every box. Occasionally he flips a switch, jots something down, or relights his pipe.

On the Go

I'm 27 and active in cycling and backpacking, so I don't fit the stereotyped image of a "ham," and I'm sure that many of you don't, either. Unfortunately, that may mean all your radio equipment is in mothballs most of the time. I have a way to let your gear see the light of day.

Solid-state equipment is ideally suited for transportation—trouble is, we still have to *operate* it, sometimes under less than ideal circumstances. Ever try to work 20m sideband while driving somewhere in a manual-shift car? If you had a headset wired to the radio, your hands would then be free to do what is most important—keeping your vehicle on the road.

A Solution

Pick up one of those personal communicator radios—that uses 49 MHz FM for short-range contacts—at most two-way radio dealers and use the headset from it. The prices I've seen range from $50 down to $22 on sale. That's not bad, especially if you've been looking at Telex prices. Even the headset from ICOM costs $40, and that doesn't have an antenna. The communicator headsets all have one earpiece, an antenna, and a boom-mounted electret condenser microphone.

Remove the headset from the radio and either file the radio parts for future projects or chuck them. There are three coax cables coming from the headset. The lead that goes "click" when you check it with an ohmmeter is the earpiece. Check for connection between the antenna rod and the remaining two coax centers, and you'll find the antenna coax that way. The one remaining is the mike (Fig. 1). Wire a 3.5 mm stereo plug on the mike and speaker wires, and a 2.5 mm plug on the antenna wire. I'll talk more about the antenna later; the headset should be all set for now.

Now make an adapter cord for your rig. If the radio doesn't have voltage on its microphone line, you'll have to modify your radio to power the mike (Fig. 2). It will still be useful for your old mike as well. If you have an extra pin on the microphone jack, run a wire to the rig's speaker. (Some radios bring speaker-level receive audio to the mike jack already; check your schematic.)

Tape Recorder to the Rescue

You're well on your way to being able to

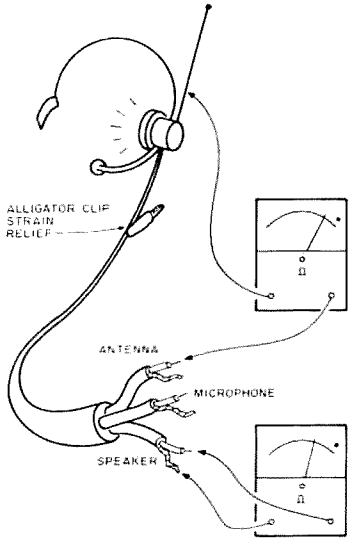


Fig. 1. Here's how to sort out which lead goes to what.

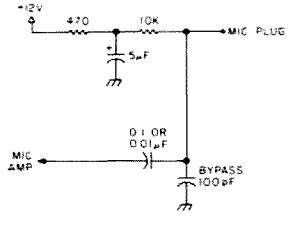


Fig. 2. You may have to bring voltage to the microphone jack.

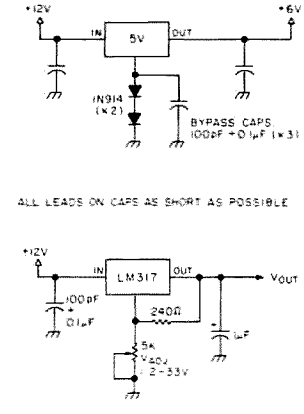


Fig. 3. Power schemes for the tape recorder.

which provides the selectivity for the receiver, and one or more of the gain stages in the receiver are adjusted to accommodate the level of signals being received at any particular instant.

Some methods sample the signal at the i-f stages, some in the audio section. The gain can be adjusted at the i-f. This particular circuit samples the signal at the audio stages, and adjusts the gain at the i-f stage. (Additional reading on the subject can be found in the references listed at the end of this article.)

The schematic in Fig. 1 shows the agc circuit added to the Century/21. Audio is taken from the headphone jack on the front panel and the peaks of the audio are detected by op amp U1A, and D1, R3, and C2. D1 rectifies the signal, and the positive peaks charge C2 through R3. The time constant of the "attack" of the agc is set by this RC network. The output of this peak detector is inverted and level-shifted by U1B so that the agc-control voltage at U1 pin 7 ranges from +6 V for no signal input to 0 V for large signals. The "decay" of the agc is determined by the RC network formed by R4 and C2.

R7 and R8 on the Century/21's front-end board set the operating bias for the i-f amplifier, Q2. This is normally fixed at +1.8 V in receive mode. Note: Before any /21 owners begin complaining, please note that the voltage chart in the owner's manual contains a typo: Q1's and Q2's values are all swapped!

By lowering the voltage on the base of Q2, its operating point can be pulled closer to cutoff, reducing its gain, until finally it will pass no signal at all. So by removing the normal voltage source by cutting at R7 as shown in Fig. 1 and adding the wire to the agc board, we have added agc to the Century/21's list of features.

The proper range of control voltage, +1.8 V to 0 V, is obtained by selecting the value of R8 on the agc board—in this case, 2.7k Ohms. This value, in conjunction with R8 on the front-end board (1 kilohm), forms a resistive divider, properly scaling the range of the control voltage.

Parts List

C1	.01 uF ceramic	Radio Shack, other sources
C2	10 uF tantalum	Radio Shack
R1, R2, R6, R7	47 kilohm, 1/4 Watt, 5%	Radio Shack
R3	1 kilohm, 1/4 Watt, 5%	Radio Shack
R4	100 kilohm, 1/4 Watt, 5%	Radio Shack
R5	220 kilohm, 1/4 Watt, 5%	Radio Shack
R8	2.7 kilohm, 1/4 Watt, 5%	Radio Shack
D1	1N914, 1N4148, etc.	Radio Shack
U1	LF412, TL084, etc.	Radio Shack

Construction

Since the circuit operates at audio frequencies, construction and parts selection is relatively noncritical. The resistor pairs R1/R2 and R6/R7 are not critical in value, but should be selected to match closely. Op amp U1 could be just about any of the common FET input types. I selected the LF412 simply because I had one in the junk box, and it had two op amps in one package. Try adjusting the values of R3 and R4 if you're of the experimental bent; the attack and hang times will change.

I mounted the circuit on the heat sink on the adjacent low-level driver board, using some of that double-sticky foam tape available at hardware stores. I used a double layer to insure against shorting through the tape. Incidentally, if you ever need to move one of those through-the-glass mobile VHF antennas, this tape is a perfect replacement for the stuff that came with the antenna.

Fig. 2 shows the foil side of a printed-circuit layout I used. On small projects like this, I generally cover the copper of a small piece of board with wide masking tape, and use a sharp knife to remove the tape where I want the copper to be etched away. It takes a steady hand and more time than it's probably worth, but it's good therapy—and what's a hobby for if not to creatively "waste" time?

Fig. 3 shows the placement of the parts for the printed-circuit layout from the component side of the board.

Operation

Operation is simplicity itself: just turn on the receiver! It is possible that when the audio gain is set very high, a noticeable "pumping" of the audio will take place. This is characteristic of audio-derived agc and would require a far more complex "cut-and-jump" to the receiver to fix. I decided to keep this project simple, and not have to perform major surgery on my radio. The cure is simply to turn the gain down until the pumping ceases. The audio level will drop very little, if at all (the agc is doing its job!), and the pumping action will disappear.

A worthwhile wrinkle to add to this project would be to put a switch on the front panel that could be used to defeat the agc when desired. An SPDT switch at the X mark on the front-end board (Fig. 1) could select between the agc and the normal circuit. Better yet, how about a switch to change the hang time by switching in different values for R4? At any rate, have fun with this project and with your new old radio! ■

References

1. *The ARRL 1985 Handbook*, Chapter 12.
2. *Solid State Design for the Radio Amateur*, pp. 90–94, ARRL.

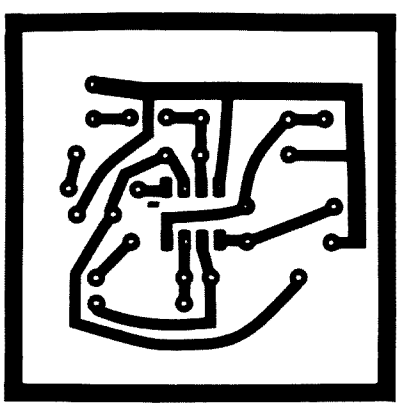


Fig. 2. PC board, foil side.

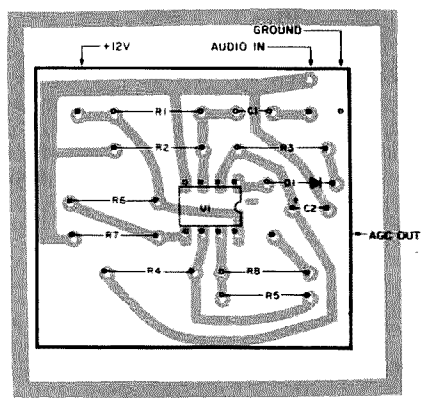


Fig. 3. PC board, component side.

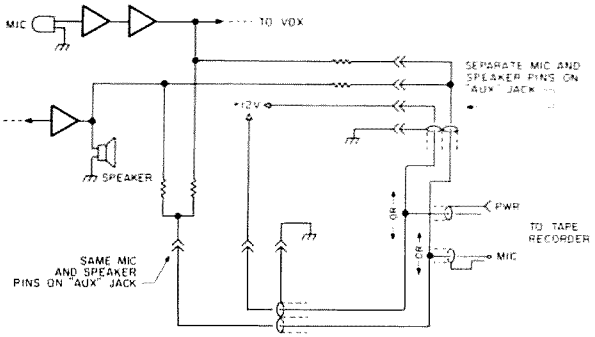


Fig. 4. Interconnection diagram.



Fig. 5. ICOM's suggestion for PTT.

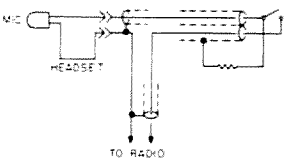


Fig. 6. PTT using the "hot" microphone lead.

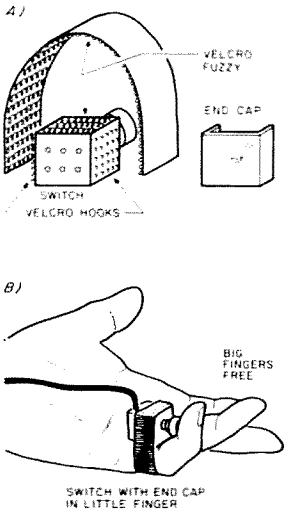


Fig. 7. (a) Remote PTT switch for an HT. (b) The remote switch in action.

run your rig in the car with hands-free VOX and a personal speaker that won't blast the wife and kiddies out of the car with the Russian Woodpecker. But you'll still want to log your contacts. I suggest an inexpensive tape recorder. Build a voltage regulator into the recorder, making sure it's well-bypassed (Fig. 3).

On the back of most ham equipment there is a jack labelled "AUX" to which is brought +12V, mike audio, receive audio (not necessarily speaker level), and so on. This can be used as the power and audio interface to your recorder.

"Ever try to work 20m sideband while driving?"

Wire it like this: The same pin on the AUX jack may be used for both receive and transmit audio to the recorder. Go downstream from the mike and find a point after the transmit audio has been amplified. Connect this point to the audio pin of the AUX jack through some high value of resistance. You'll have to experiment to find the correct value. Do the same with the receive audio (Fig. 4). You will probably end up at the speaker. With the resistors in the circuit, the receive audio shouldn't trip the VOX, even though it is connected to the transmit line, due to the high isolation provided by the resistors.

Now when you're driving down the road, you can talk to someone with your hands free, except for when you're starting and stopping the recorder. To record the time, frequency, and other information, just turn the drive all the way down on the transmitter and talk normally. The radio won't put out any power, and your voice will be recorded.

On to Two

Next, the 2m hand-held. If you want hands-free operation, you could strap your HT onto your belt and fry your kidneys. Instead, build an adapter that converts the antenna fitting of your radio to a 2.5 mm jack. Disassemble the earpiece of the headset (it usually snaps apart); inside, there is a small coil which matches the headset's antenna to 49 MHz. Bypass this with a blob of solder on the pins, and reassemble the earpiece. The antenna should be about 19 inches long, which is a good match for 146 MHz—I measured the swr on mine, and it was acceptable. On-the-air tests comparing the headset antenna with a rubber duck at waist height confirmed that the whip outperforms the duck.

Now to key the radio. ICOM suggests keying the mike ground line, but to do so would have made the headset unusable for other radios that I own (Fig. 5). I opted instead to key the positive line. I found in my junkbox a switch that fit nicely under my little finger, and wired to it a suitable length of of double-shielded wire (Fig. 6).

To keep the switch in my hand, I added some Velcro to it (Fig. 7a). Solder the braid of the coax to the switch body for strain relief and use enough wire to go up your arm and down to the radio. To keep the wire in place, I used elastic bands at the elbow and up my arm. To help with strain relief on the headset, take an alligator clip and crimp it around the wire just below the earpiece and use that to clip onto your shirt (Fig. 1). The radio goes on the belt. It's really fun to go cycling around town with this getup on. I've received some good double-takes doing this.

For the really hard-core enthusiast, you can get a mobile antenna mount, an "L" bracket, and a suitable plug, and mount everything on your external-frame backpack. A quarter-wave whip will work fine (a 5/8 will look weird) and it can double as a stainless-steel marshmallow stick. Now you can go off to the mountains, the seaside, the desert, or whatever and have emergency communications, provided you can reach a repeater. To be sure the battery doesn't freeze and die, keep it in your jacket during the day and in your sleeping bag at night.

Now all I have to figure out is how to get HBO on the Cascade Crest Trail... ■

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Remote-Controlled Everything

Secure, wireless control for your next project is no longer a remote possibility.

Remote-controlled garage-door openers are becoming so common now that many people, including me, consider them as much a necessity as a toaster or lawn mower. Almost all door openers use a radio link to start the motor that raises and lowers the door.

Have you ever looked at that little transmitter clipped to the visor of your car and wondered what was inside? Maybe you opened it up (after all, you're a ham, right?) and were surprised to see only a small handful of parts. I'll bet you thought, "Gee, and they want thirty bucks for a new transmitter!"

Maybe you also started thinking of all the neat uses you could have for a small remote-control system that could reach up to 200 feet or so. How about a remote PTT switch that could key up your transmitter in the shack while you stand at the antenna with the swr meter? Or a remote TV or light control?

How about a wireless doorbell for the front gate? Or maybe a beeper in the house that alerts you when the mail arrives? The possibilities are endless. The only reason you haven't done these already is because they sounded too complicated, right? After all, you'd have to build a complete transmitter and receiver for each use.

I'm going to help you build a simple, secure radio link that can be used as the basis for a very reliable home-security system, or any other use you can think of.

Look at Fig. 1. At the left is a push-button switch that powers up the rest of the transmitter when closed. The digital-coding IC sends a serial stream of pulses to the base of a single-transistor oscillator. The oscillator turns on with a high pulse, and is off between pulses. The antenna is usually just the oscillator's inductor stretched out so that it will radiate better.

This on/off signal (just think of it as fast CW) is picked up at the receiver by a superregenerative detector. Back in earlier times, many simple receivers built by hams used superregenerative detectors. They have their limitations, which we'll talk about in a moment, but it's hard to beat a single-transistor receiver for simplicity!

The output of the detector is a demodulated audio signal that is amplified and sent to a decoder IC. If the codes selected in both the transmitter and receiver match (usually set by DIP switches), the receiver IC keys a relay that stays activated as long as the proper code is still being transmitted. The relay contacts can be used to ring a bell, fire a cannon, or whatever is desired.

Encoder/Decoder Chip

Simple, right? The system's reliability is based on the digital encoder/decoder chip's ability to make sure that only a particular code will close the relay, and not random noise or other signals coded differently. Most manufacturers of garage-door and security systems use their own proprietary coding ICs that are purposely incompatible with each other. All are based on the same principle, though.

Look at Fig. 2. This is a pinout for the National MM53200 chip. It is available from several sources, such as Jameco. Pins 1 through 12 are for setting the code you want. Twelve inputs means that you can have 2^{12}, or 4096, different codes. The connections to these pins must match in both the transmitter and the receiver. Fig. 3 shows how the connections should be made. Either a DIP switch or jumpers can be used. The IC has internal pull-ups on the code input pins, so they are either grounded for a 1 bit or left open for a 0 bit.

". . . this chip set uses trinary coding with nine bits, which gives 3^9, or 19,683, different codes possible!"

Looking at the other pins, you see a 100k resistor and a 180-pF capacitor. These two parts set the chip's internal clock frequency at about 100 kHz. Use 5% components, but do not be concerned if the clock frequencies in the transmitter and receiver do not match exactly. You would have to have at least a 15% mismatch before they wouldn't work together.

If you don't have the values specified, substitution is all right. The formula for the clock frequency is 2/RC. Other values like 47k and 470 pF are fine. You can use any other frequency, like 50 kHz, if you want, as long as the transmitter and receiver are the same. The oscillator input pin can also be driven by an external oscillator. In that case, you would delete the resistor and capacitor.

Pin 15 decides whether you have a trans-

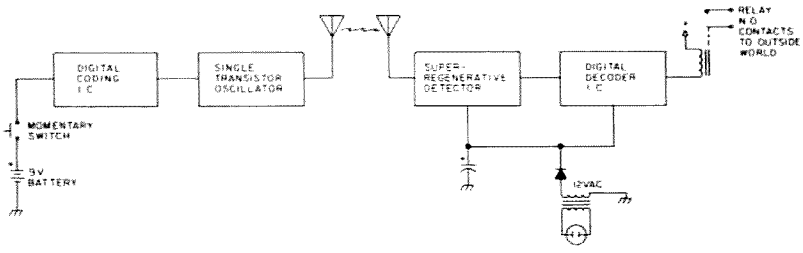


Fig. 1. Remote-control-system block diagram.

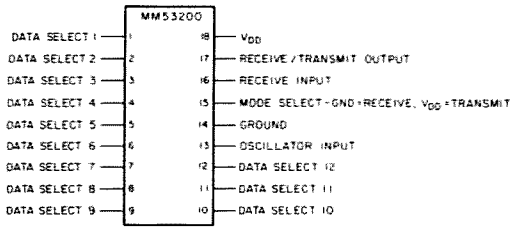


Fig. 2. Pinout of the National Semiconductor MM53200 encoder/decoder chip.

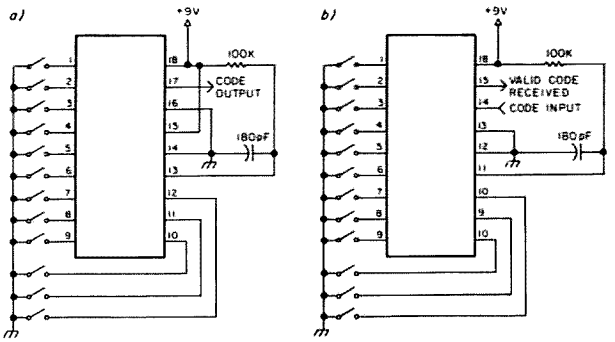


Fig. 3. Wiring the chip for: a) transmitter operation and b) receiver operation.

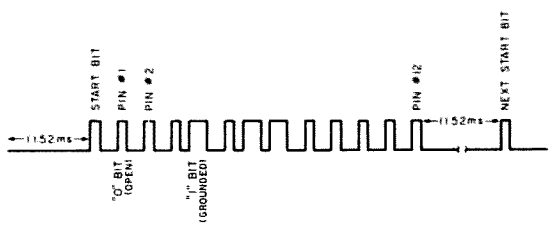


Fig. 4. Data format as sent by the transmitter chip when pins 4, 6, and 7 are grounded.

mitter or a receiver. Grounding it gives you a receiver. Connect it to the battery supply (pin 18) for a transmitter. Do not leave it open. If it is a receiver, send the data in on pin 16. If it's set up as a transmitter, the data comes out on pin 17, and pin 16 is grounded also. I recommend that you test the setup in Fig. 3 with a solderless breadboard, first. Just connect the code output, pin 17, from the transmitter to the code input, pin 16, on the receiver. Then watch the normally-high output from pin 17 on the receiver go low when the codes match. You can do that with a low-current LED or a voltmeter. Later on, this output will drive a transistor that will energize a relay.

Fig. 4 shows the nature of the data being sent and received in this system. Starting from the left, there is an 11.52-millisecond pause, then a start bit, then the twelve data bits, then another pause, then a start bit, etc. This data stream is continuous as long as the transmitter is powered up.

The start bit and twelve data bits make up one word. A word is the same length as the pause between words. The receiver chip has to see 4 words in a row that are valid (the transmitter code matches the code on the receiver switch inputs), and then pin 17 will go low. Do not try to drive an LED directly with this pin unless you use a low-current type. The pin will sink only a maximum of 2 milliamps.

There are other encoder/decoder ICs available, such as Motorola's MC145026, 27, 28, and 29. This is also second sourced from SGS-ATES. The 26 is the transmitter. There are three different receivers which vary mainly in how they treat the incoming data. The MC145028 receiver is like the MM53200 in that all of the bits are compared and a single output signals that they match. The 27 and 29 divide up either the first 4 or 5 bits as a valid address and the remaining bits as individual channel selects.

Another interesting thing is that this chip set uses trinary coding with nine bits, which gives 3^9, or 19,683, different codes possible! The code input pins are either high, grounded, or left open.

There is also a large number of TV remote-control chips from just about every IC manufacturer. These are made to operate with an infrared link, but most will work with rf. The major disadvantage with them is that they have no real security code to set, just bit patterns representing which switch on the keypad is pushed, but that shouldn't stop you from using them. Very few are used with rf links, and they are great if you need several channels with a single transmitter and receiver pair. An example would be for controlling the various movements and functions on a robot.

The Transmitter

Let's build a transmitter first. Fig. 5 shows how simple it can be. Don't be concerned if you don't have some of the exact part values specified. R1 and R2 can vary by 2:1 (don't go below 47k on R1), and I have listed most of the transistors that can work in this circuit, including one (MRF-901) that can be bought at Radio Shack. It is a real overkill for this circuit, though. If you have trouble getting parts for any of these circuits, they are available from me for a nominal cost as long as you don't want hundreds of them.

Returning to Fig. 5, we find a simple Pierce oscillator that has feedback from base to collector. Many hams don't have a solid understanding of what makes an oscillator oscillate. An oscillator is simply an amplifier tuned to the desired frequency that has some feedback from output to input.

Feedback means that a portion of the output signal is returned to the input, like the howl in a public address system when the volume is turned up too high. What happens then is that the microphone amplifies what it hears again and again. The howl is actually an amplifier being made to oscillate at the resonant frequency of the room, speakers, and microphone in combination. That's why you can get different frequency squeals by moving your hands around the mike. Your hands change the level and emphasis of frequencies heard by the mike, and therefore the pitch of the squeals you hear.

What we have to do in an oscillator is get a 360-degree phase shift through the entire circuit, and it *has* to oscillate if the transistor has enough gain. A 360-degree phase shift means that the amplified signal arrives at the base ("or collector or any other part of the loop") looking just like the signal just arriving, but delayed one full cycle.

If the fed-back signal were compared with the arriving signal on a dual-trace oscilloscope, the signals could be laid over the top of each other and they would match (except that

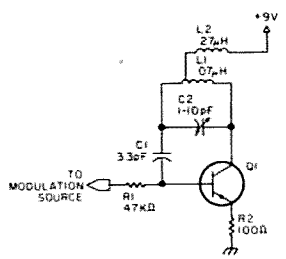


Fig. 5. The transmitter rf oscillator. Q1 can be a 2N918, 2N5179, 2N5770, 2N3563, MPSH10, MPSH11, or MRF901 (Radio Shack 276-2044).

their amplitude, or levels, wouldn't be quite the same). An old joke with rf engineers says that the sure way to build an oscillator is to design an amplifier, and vice versa! That's very true. . . feedback makes the difference.

Since we are using an NPN transistor, the base and collector are always acting oppositely, or, as the voltage rises on the base, the transistor conducts, and the voltage on the collector falls as the collector pulls more and more current. This means that the base and collector are 180 degrees out of phase, because they are acting oppositely.

Now we have half of the phase shift we need. The other half, another 180 degrees, comes from L1 and C2 in series with R1. Unless there's lots of loss through these components or the transistor doesn't have enough gain at the high frequencies we're using, the circuit should oscillate!

When you're testing this circuit, the hardest part will be finding out what frequency you're on. I'll show you how to build a simple detector to test it and make sure you're transmitting *somewhere*!

R1 and R2 are carbon film or any other type

(except wire-wound, of course). Many rf circuits specify carbon composition, and I find this to be unnecessary. Decent carbon comp. resistors are becoming harder to find, and their quality has suffered. (In the September, 1985, issue of *QEX* I go into some detail explaining this.)

C1 should be NPO for best results. NPO means that it won't change values with temperature changes. C2 can be a Radio Shack 3- to 10-pF trimmer (272-1338). L2 can be a miniature .18- to .39-microhenry choke or coil. Just take a 1/4-Watt resistor that's 1k Ohms or more and wrap 5–8 turns of small wire evenly around the body. You can use 20- to 30-gauge wire of any kind. Wire-wrap wire is fine, too.

LI is simply a hairpin loop of wire of any gauge. Heavier wire will be more stable. I recommend 12- to 14-gauge house wiring with the insulation removed. The same applies to the receiver's L1 inductor. Start out with a straight piece of wire about 3 inches long and bend it in half around your little finger like a large hairpin. A circle is all right, too. The real trick in this circuit is to get it as mechanically stable as possible.

Ideally, L1 should be a printed-circuit trace about .025 inches wide with C2's leads going through holes in the PC board, soldered across LI. You might try tacking your inductor to an unclad (no copper on either side) portion of your PC board with super glue in several places. The circuit will drift all over the place unless you get LI and C2 so they don't move when you go to tune C2. You should also mount the transmitter in a plastic case, such as Radio Shack's 270-291. It also comes with its own perfboard.

Component-mounting methods are up to you. The simplest is just to tack-solder the component leads to each other over a small square of unetched PC board. The components that go to ground form the mounting feet for the circuit. Keep all component lead lengths to ¼ inch or so.

L2 should be tapped on L1 about 25% of the way from the transistor base. Too close to the base, and it won't oscillate. Too far, and it gets less stable. If you've bent L1 into a hairpin shape, just put the top halfway between the bend and the base, then move just a little back towards the bend for good luck. Better to be a little unstable than not to oscillate.

To test the circuit, tie R1 to 9 volts temporarily. The circuit should draw about 5-10 mA from the battery. Now you have a CW oscillator that is probably oscillating somewhere between 180 and 500 MHz. Most garage-door-opener radios are between 290 and 400 MHz. Unless you have a spectrum analyzer (about $12,000), you won't know where you are. The circuit in Fig. 6 is a simple diode detector to show you that you're oscillating somewhere. At this point, that's all you need to know.

If you have cable TV, you can stick a short antenna into the cable converter or cable-ready TV's input, tune it to channels K or 24 (223–25 MHz) through X or 37 (301–25 MHz). Tune C1 through its full range, and at some point you should see a change in the picture or sound of the TV. Shorten or lengthen L1 if you get nothing. Please use an insulated tool. It's frustrating to watch your signal drift off as you pull your Craftsman screwdriver away. It could also cause your circuit to stop working.

The same tuning procedure applies with the diode detector. The pickup loop may have to be almost in contact with LI before you get an indication. The most you'll see is about 2 to 7 volts. Any indication at all shows that you are transmitting. If you're in doubt about the detector, try it carefully with your 2-meter rig or HT. You'll see a lot more indication with the higher power gear.

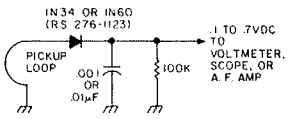


Fig. 6. The diode detector will give an indication that the transmitter is working. The pickup loop should be one turn about the same size as the transmitter loop, or larger. Use a dc voltmeter on a 2-volt scale, or a scope. An audio amplifier will work if the transmitter signal is modulated.

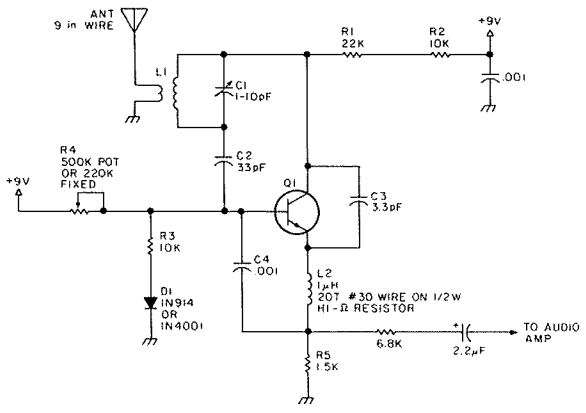


Fig. 7. The receiver. Q1 is the same transistor as is used in the transmitter. Experiment with the antenna and its coupling loop only after you have the receiver working. You should still get 100 feet or so of range just using L1 by itself.

"Although the likelihood of the radio police descending on your house is extremely small, it is your responsibility to make sure that you do not interfere with anything else."

Now that you have your transmitter working, smile smugly at your abilities and go to work on the receiver. You might also connect R1 to pin 17 of your code-transmitter chip and observe the code being sent on an oscilloscope connected to your diode detector. Or you could connect the detector to an audio amplifier and hear the musical buzz the code chip makes. It may also make some interesting viewing on your television!

A Super- What?

Superregenerative detectors are still used today in a variety of things such as radar transponders, aircraft altitude-measuring radar, police radar detectors, inexpensive radio-controlled toys and walkie-talkies, and garage-door-opener receivers. The main reason they are used is because of cost and circuit complexity; it's hard to beat a one-transistor receiver. Their main disadvantages are that they are limited mostly to AM and pulse detection. They also tend to emit quite a bit of rf. This can be controlled somewhat by isolating the detector stage from the antenna with a preamp.

Looking at Fig. 7, you might think that you're looking at an oscillator circuit. We have the Pierce-type tuned circuit connecting between the base and collector of Q1, just like the transmitter we built. The main difference here is that we connect C4 into the circuit and it, along with L2, R3, and R4, form another low-frequency oscillator at about 200 to 700 kHz. If you have the interest, you could disconnect C4 and observe that you now have a single frequency oscillator just like the transmitter.

A superregenerative detector is basically an oscillator that is rapidly turned on and off. This circuit turns *itself* on and off, so we call it a self-quenching detector. You could also turn it off and on externally with a sine- or sawtooth-wave generator connected to the transistor base through a small choke. Square waves are not desired here as they spend little time in transition (the time between fully on, or a logic high, and fully off, or ground). During the transition period, and when the transistor just begins to conduct, amplifica-

tion of an incoming signal is achieved on the order of a *million* times, or more! That's why we can get such good sensitivity from a single amplifier stage.

The receiver in Fig. 7, although not the best, can hear signals as low as 3 to 5 microvolts. Adding a preamplifier (even a $10.00 Radio Shack TV amplifier) will help increase sensitivity and also cut down on detector radiation through the antenna. For long-term use, I recommend doing this and also putting the entire receiver in a shielded enclosure.

Why not use a superheterodyne receiver, with sensitivity down in the .2-to-.5-microvolt range? Cost, complexity, and attention to the vagaries of careful rf layout come to mind. Also, you don't need the narrow bandwidth achievable with the superhet here. The transmitter will drift as much as 2 MHz under handling and tuning, and you're going to have enough concern just finding the transmitter signal at first. You don't need razor-sharp tuning right now.

Building the Receiver

Let's look at Fig. 7 again. L1 is another loop of stiff wire, or firmly mounted smaller gauge. The antenna and its coupling loop shown in the schematic are optional. The coupling loop should be another single turn lying next to L1 on the PC board about ¼ to ½ inch away. I recommend you just worry about L1 initially, and experiment with the antenna later. The pot, R4, can be replaced with a fixed resistor after setting the quench frequency to about 300–600 kHz, as measured by a scope or frequency counter at the junction of R1 and R2. That's why we have the two resistors there instead of a single 33k resistor.

If you don't have a scope or counter, you can still make this circuit work fine. You'll need a medium- or high-impedance audio amplifier. I recommend one anyway, and I even use one myself. I have a little box with an LM-386 IC and a 9-volt battery. You could do a lot worse than the one Radio Shack sells for $11.95 (227-1008). It's the same thing, basically.

Connect the amplifier up to the audio output point shown as you tune R4 through its range. C1 should also be turned if nothing happens, or put it in the center of its range. You are listening for the characteristic rushing noise, or hiss, that tells you the detector is oscillating. If you hear nothing, touch the transistor base with your finger. If you don't hear a slight hum or squeal, then there is something wrong with the dc connections of the transistor, such as R4, R3, D1 (it's not backwards, is it?), L2, R5, or R1 and R2. Or maybe the transistor itself is connected wrong.

You may hear squeals and burps, but somewhere you'll hear the hiss. You might also try shortening or lengthening L1, which is just about the same size as L1 in the transmitter. If you turn on your unmodulated transmitter, the hiss will suddenly quiet down as it's tuned to the receiver. If you connect up your code-generating chip to the transmitter as I suggested, you'll hear the musical buzz in the receiver. At this point you have a working receiver.

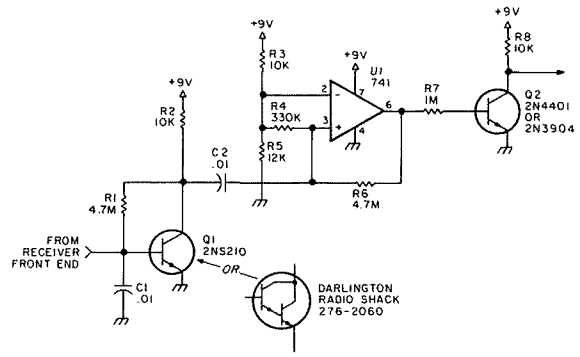


Fig. 8. The audio amp, comparator, and inverter. Use a 2N5210 if possible, or a Darlington such as Radio Shack 267-2060, an MPSA13.

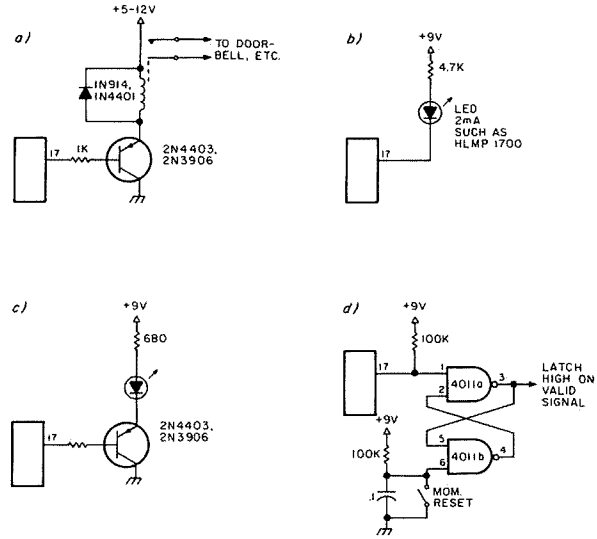


Fig. 9. Various ways to connect the decoder-chip output to the outside world. a) Driving a relay. b) Using a low-current LED. c) Using a regular LED. d) Providing a latched output. Pin 3 of the 4011 flip-flop latches high on receiving a valid radio signal.

By changing the value of L1 and C1, you can make this receiver work on just about any frequency. Now all you need is a circuit that amplifies the signal sufficiently so that the receiver chip sees nice, square 9-volt pulses.

Look at Fig. 8. The low-level audio signal is amplified by the 2N5210 transistor. This is a low-noise, high-beta (about 250–500) transistor. Use it if at all possible. You could also use two NPN units connected as a Darlington pair, or Radio Shack's 276-2060 Darlington. You should then change the base bias so that the transistor collector idles at about 4.5 volts (not critical).

Use a high-value resistor, above 500k, from Q1's base to ground to limit conduction of Q1. C1 cuts down on the amount of the high-frequency quench signal that is amplified by Q1. U1, a 741 op amp, is used as a voltage comparator and Schmitt trigger. It toggles between 9 volts and ground (almost) with a signal greater than about .3-volts input. Q2 then inverts this signal back to what it was at Q1's base.

Check and see that the Q2 collector swings less than 2 and greater than 8 volts. If it doesn't, change the value of R7 till it does. This can be verified with a scope at the collector when the receiver is receiving pulses, or by temporarily shorting pin 3 of U1 to 9 volts and ground.

Now you have a working system. Connect up the decoder chip and, with a VOM or scope, watch the normally high output pin 17 go low when it gets a valid signal. Make sure that the codes are set the same on the receiver and transmitter. If it doesn't work, look at the signal at the output of the transmitter chip. The wider pulses correspond to grounded code-selection pins 1–12. There should be very little other noise or few glitches on the received signal as the decoder chip sees it.

Output Connections

Fig. 9 shows several suggestions for connecting the outside world to the receiver. At 9(a) is the setup you'd use to replace your present garage-door receiver. Just connect the normally-open contacts of your relay across the external push-button

contacts on your door opener. At 9(b) is a low-current LED to use as a simple indicator. If you have a standard LED, use the circuit of Fig. 9(c). If you need a latched output, use 9(d). You could also have an alternate-action output (push once for on, again for off) by connecting the decoder IC output to a D or JK flip-flop. The possibilities are up to your ingenuity.

Is It Legal?

Finally, a word about the FCC. Unless you tune your remote-control system to a ham band and use it as a licensed amateur, transmitter and receiver use are controlled by Part 15 of the FCC's rules and regs. Part 15 covers all low-power, unlicensed radios and computers capable of emitting radiation into the airwaves. Ever notice that sticker on your FM radio or TV set that says it complies with Part 15? That means that the receiver emits local oscillator radiation (or any other signal) that is below limits set by Part 15, so that nobody interferes with anybody else. Ever listened to 80 meters when a nearby TV is on? It interferes with you, but at prescribed FCC limits!

Anyway, you are required by 15.133 to put a sticker on your receiver and transmitter that says:

> I have constructed this device for my own use. I have tested it and certify that it complies with the applicable regulations of FCC Rules Part 15. A copy of my measurements is in my possession and is available for inspection.
>
> (Signature)_____
> (Date)_____

Paragraph 15.133 also says that you cannot construct more than five devices of the same configuration (that means identical schematically and physically). Otherwise you need to apply for a manufacturer's registration number and submit the proper paperwork for certification of the device to the FCC. So what do you do? The units described in this article can easily be made to radiate more signal, either fundamental or harmonics, than they should. The amount of radiated signal is very small, even for the transmitter. It is something on the order of about 20 microwatts, but unless you have a 3-meter test range required by the rules, you will not have the proper equipment to test them for compliance.

Although the likelihood of the radio police descending on your house is extremely small, it is your responsibility to make sure that you do not interfere with anything else. Avoid tuning the transmitter to MHz ranges 242.8 to 243.2, 265 to 285, 328.6 to 335.4, or 404 to 406. These are forbidden areas that may cause interference to government or aircraft navigation (especially 328.6 to 335.4 near an airport). To avoid all this, tune yourself to cable channel K, which is in the 220-MHz band, or channels 57 to 61 (hyperband), which is in the 70-cm band. The possibility of interfering with any repeaters is almost nil, due to the very low power used here.

Conclusion

It is possible to make these units fit in a very small space. I used 2" x 3" board stock for the receiver and 2" x 2" for the transmitter, with room left over.

If you have problems getting your setup to work, get in touch with me. I will even fix your project in the event you can't get it going. Please include proper return postage for whatever you send. A semi-kit is also available from me for $15.00. This includes all the parts needed for one transmitter and receiver pair, less case. This kit does not include etched PC boards, but does include blank PC stock to tack-solder the components to each other.

Etched boards may become available if interest is great enough. I can also supply individual parts, such as the coding ICs and the 2N5210, etc. Contact me for price. SASE, please, for all correspondence.

If you're interested, I can also direct you to a dealer in your area who can sell you units manufactured by Linear Corporation that are tuned to 310 MHz—I can get them direct for you. The cost for a single transmitter and receiver pair should be about $45.00. ■

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NEVER SAY DIE

from page 10

bers get all involved in some really inconsequential matter—but then, for some reason, there are fewer and fewer turning out for subsequent meetings. Suddenly the club drops below critical mass and it's gone. I remember one club I used to go to which had one hell of a session over what color to paint the clubhouse. I don't think the club ever really recovered.

Check with the members and see what they think is fun. I'll bet you find the part of the meeting when they're able to stand around and talk with friends is right up there on top. The feeding frenzy is another winner. In addition to the fun of eating there's more talking with the friends. But how many clubs put off the feeding until the end of the meeting? Most!

It's fun to get in someone who can give a rousing talk. Sadly, we haven't many rousers in hamdom. If you've got a ham firm in your area, you might try inviting the entrepreneur involved. In general, entrepreneurs are interesting. They're all wrapped up in what they're doing. You must have a manufacturer or seller of some kind of ham gear within commuting distance to liven up meetings. Buy him a dinner and bring in the biggest crowd you can for him.

Another potential entertainment for your club meeting (party) is a member who's a fanatic on some aspect of hamming. You've got 'em, so dig 'em out, brush off the dirt, and have 'em explain why they're a nut case over slow scan, packet radio, OSCAR, high-speed CW, or whatever insanity has pushed them over the edge. Show and tell.

I suggest you do all you can to keep your parties clean. Keep alcohol out. That's right, kill the 807s. Alcohol does different things to different people, but it has one action in common for everyone—it makes you stupider than you were before you drank. Of what value to your club are a bunch of stupefied members falling asleep? Alcohol quickly lowers the level of awareness, making some people laugh more, and some more surly. You don't need either of these to spice up a meeting. No beer.

With a growing percentage of the population angry over smoking, bar it from meetings. Get your serious addicts to make a short trip outside to smoke when they can no longer live with their nicotine withdrawal pangs. When I give talks to clubs I always ask for no smoking—and I generally get a round of applause for saying it.

Instead of having the club entertainment committee buy cheap junky doughnuts and coffee, how about getting members' XYLs involved? Get members to bring in some munchies, dips, and other dishes for the meeting? I've been to clubs doing this and the quality of the food is way above the usual supermarket Twinky crap.

Solving Problems

Once you have your club growing, you're going to be able to start dealing with local ham problems. Have you got a TVI committee yet? No ham should ever have to handle his own TVI miseries. Any TVI complaint should be tackled by the club TVI committee—first checking the ham station to make sure it's clean. Next the committee should visit the complainer, give him a printed form explaining the whole situation in lay terms, and then attempt to get past the accrued anger to work toward a solution. Has your club a printed information sheet explaining TVI? Let me see it so I can publish some of the better ones to help other clubs. Heck, if there's a demand, I'll even get my print shop to print some up which can be bought in bulk.

The next thing you need is a committee to tackle repeater problems. If there is a statewide repeater alliance, fine, get one or two delegates from your club to attend their meetings. Even if your club doesn't have a repeater, which is unlikely these days, your club still has a strong vested interest in local repeaters being operated well.

Your club also should be in touch with the local repeater coordinating group and make sure they know you're watching them. If they start screwing up, call 'em in to explain at your next meeting. The repeater alliances and coordinating committees are only as strong as the clubs which support them.

It has not been satisfactorily determined as yet as to whether people become hams because they are crazy or whether hamming makes people crazy. We do know that, with the sole exceptions of you and me, all hams are crazy. On this premise, you shouldn't be surprised at anything which happens in amateur radio. The trick is to gear your club to cope with this craziness—with both the copers and copees being accepted as crazy.

My suggestion is this: Just as you have a TVI committee to cope with irate television owners—or hi-fi, hearing aids, etc.—you should put together a small A-Team to tackle local repeater jammers and other such trouble-makers. I like the A-Team concept—a small group of dedicated individuals, all with sneaky brains aiming at outsmarting the bad guys, but with no bloodshed. Have you ever noticed that the A-Team can shoot from the hip with a machine gun from a bouncing van at night and shoot a rope in half at a hundred yards with the first round, yet not in several years and hundreds of thousands of rounds have they ever been able to hit a bad guy? I don't think they've even winged anyone! So get your A-Teams going and make sure they don't aim for the kneecaps (like I might). Hey, I'm talking figuratively, in case there are any old farts who suddenly want to take me seriously in order to righteously put me down. I already mentioned how many nut cases we have in our blessed hobby—except, as I said, for me and thee—and I'm not entirely sure about thee.

The ham who is so determined on screwing up amateur radio for the rest of us that he ignores the first visit or two from your A-Team will call for strategy. Perhaps a mass visit from the entire club, with or without flaming faggots and pitchforks? Bring plenty of marshmallows in case the house burns by accident from a flying spark. Figuratively speaking again, of course (heh, heh, heh).

Self-Policing

The A-Team approach via local clubs will help a good deal to clean up our act. We do have to be wary of officious self-appointed police. They can cause more problems than they solve. The ARRL had a good idea with their Official Observers, but all too often OOs got carried away with their work and went overboard. I think we need something along that line—hams with the time and patience to act more like corner crossing guards than police. A polite reminder that someone is operating in the wrong subband. A suggestion that the mike gain or the compression be turned down to where the voice can be deciphered. A plea to well-known DXers not to jam the weak DX station once they've contacted it so as to keep others from getting the country. These are all delicate matters, calling for tact rather than the often used verbal rubber hose.

There are far more good guys in amateur radio than bad, so if the good guys use the strength of working together, they (we) will prevail. By the way, the bad guys know who they are. They are defensive about it, but they know they are the bad guys. Most of them are emotional basket cases that use being bad as a way of getting attention—like a bad child. We don't have the resources to put these jerks under psychiatric care, where they belong, so we just have to learn patience and deal with them one by one.

The Future

As we are able to bring our clubs up to strength—with representatives from each working with the area repeater councils—the next step is for us to get going with a national meeting every two years, with two delegates representing each ham club, to discuss and vote on needed rule changes.

As with the Geneva ITU meetings, this group should first break into working committees to discuss each proposed change. The committees would then report their decisions to the group as a whole—the plenipotentiary—for their vote. This vote would be binding and automatically enacted by the FCC. I've discussed this with the FCC commissioners and found them enthusiastic.

This would have many benefits for us—and the FCC. It would save us years in making our rules reflect the state of the art. In the past, virtually without exception, we amateurs have done our best with a minimum of rules. But we've always had a nut case or two who flatly insisted on getting the FCC into the act. I don't think anyone can remember a time when the resulting rules were needed or appropriate. I've always advised experimenters and pioneers not to ask the FCC when there is any question. If something is not specifically prohibited, then it is permitted, so go ahead and do it. Asking a government bureau-

crat to go out on a limb by authorizing something which has not previously been specifically authorized is incredibly dumb. The easiest answer is no, so that's what you get. Don't ask.

Getting our clubs involved with proposed rule changes will help develop more interest in the clubs and amateur radio. It'll give club newsletters a lot more to cover—and perhaps even make ham magazines more interesting. Right now a very small vocal minority has an outsized effect on our rules.

Executive Summary

So there you have it—the FCC hasn't the time or the money to deal with amateur radio. We need to take responsibility for ourselves. Remember, with Gramm-Rudman, it isn't going to be the 70% of the budget for entitlement payments which is going to get cut, it's going to be government bureaus like the FCC, so they're going to be able to do less and less for us.

It's time for amateur radio to face this situation and accept the responsibility. We've got to organize for the growth we need. We've got to build more and stronger clubs. We've got to organize for the growth we need. We've got to build more and stronger clubs. We've got to recruit and train new hams—and get older ones enthused to do more.

We don't need Big Brother for anything, so let's get moving toward cutting the umbilical cord.

TRANSMIT MUSIC—LEGALLY

Yes, at long last you can legally transmit music on the ham bands! However, before you start plugging your record player into your mike jack, you'd better read further. A lot further.

Now, all you youngsters sitting around old Doc, let me tell you why music is prohibited on the ham bands. You see, back before World War II, way back in the 1930s (yup, I was there–I'm a living monument to the past) we had two basic classes of ham licenses, Class B and Class A. To get the Class A license, the advanced radiotelephone license, you had to pass a stiff (for then) technical exam on radiotelephone technology. Whew!

The Class B ticket was pretty much like today's General license, complete with 13-wpm code. But 90% of the Class B licensees operated only CW. The Class A ticket allowed you to operate in the 75m and 20m phone bands, each 100 kc wide (kHz hadn't been invented then). AM phone, it was.

Class B could operate on 160m and 10m phone. Well, 10 was a VHF band then and almost completely unused. Experimental. So the B-ops either operated CW or hung out on 160m phone. 160 was a big band then, running from 1800–2000 kc—later expanded to 2050. We even had an almost totally unused CW band from 1715–1800.

40 was the big one. It was CW only and packed solid. Everyone used crystal control, so the practice was to call long CQs and then tune for minutes up and down the band. You could expect a call from *anywhere* in the band. It wasn't until variable frequency oscillators came along (vfo's) after the war that one tuned near one's own frequency.

DXers fought it out on 20m CW. Traffic nets and rag-chewers were on 80 CW, which ran from 3500–3900 kc. The B-ops on 160 mostly used simple homemade rigs. The most popular was a 6L6 crystal oscillator modulated by a 6L6. In the cities 160 ops would build afternoon groups rebroadcasting each other from one end of 160 to the other so everyone in the group could hear everyone else. Sure, six ops would tie up six frequencies, but heck, there weren't enough of us so it made any difference, even in New York City. We called it duplex operation. At night 160 was too crowded for this as stations from the whole East Coast would be heard.

But then, as today, no sanity exam was given, so we had as high a percentage of crazies as we do today. Some of these boneheads would get on 160m and play records all afternoon. Eventually the FCC got fed up with this crap and passed a rule which made it illegal to transmit except for the purpose of communications. This meant no one-way transmissions (except by W1AW), no blank carriers, no music, and, sadly, no more duplex.

Of course duplex today on most of the low bands would be too wasteful of frequencies. Remember, we went into World War II with only 50,000 hams. Remember, too, 40,000 of us joined the military! Without us our country would have had a lot tougher time. It was electronics which did much to win that war.

Now, getting back to a legal way to transmit music on any ham band. Have you figured it out yet? Simple, really. Just consider what's happened with digital audio. Our compact discs are merely encoded with digital data which a computer can translate as music. It's those old zeros and ones, just like any digital communication.

So, as long as you send the digital information over the air, it doesn't make any difference whether a computer translates it into words, music, or pictures.

Hold it. Don't plug your CD player into your mike jack either. Your player has a built-in decoder so you get analog out. Music. You need a CD player with a digital output—like we're starting to see for CD-ROM use. Here's one more dash of cold water: Since digital audio is sampled at 44 kHz, you're either going to have to transmit a very wide band to send it in real time or else slow it down the way we do with SSTV—so you don't take up too much bandwidth. Okay, so it could take ten hours to transfer a one-hour CD. You want to bet some damned ham somewhere doesn't do it just to prove it can be done? Probably to Africa on 20m too. Anyone want to offer an award for the first DX music transfer on 20m? Let's keep it to the "Minute Waltz," okay?

If you're interested in digital audio, guess what? I also publish (surprise) a magazine called *Digital Audio*. It's going gangbusters—devoted mostly to reviewing new CDs and CD players. It should be on your local newsstands. If you have a CD player, you really can't get along without the magazine. You see, far too many of the new CDs are disasters—and, at around $12 each, it doesn't take many bum CDs to more than make up for a subscription to *Digital Audio*. We review a hundred or so CDs in some issues.

Let me know if you try sending digital music, okay?

WESTLINK WINS ONE

Bill Pasternak WA6ITF's *Westlink Report* got the news out accurately on *73*'s move to WGE from CW Communications. Good work, Bill! The staff changes, cited as major by W5YI, were less than that, as can be seen by checking old *vs.* new *73* mastheads.

Perry Donham KW1O is back as Editor after a short stint at *inCider* Magazine. Steve Jewett KA1MPM is here, too, taking on the task of Production Editor, learning our state-of-the-art computer production system. Chris Schmidt came on board last week as Managing Editor. The rest of the staff is the same... International Editor Dick Phenix, Editorial Assistant Carole Macioci, Art Director Dianne Ritson, Designer Susan Hays, and Marketing Manager Hope Currier.

Jim Gray left, moving to *Modern Electronics*, I understand. Nancy Ciampa moved up to Sales Manager. Stu Norwood, who edited *73* several years ago, is back. Several other past *73*s staffers are also back with the magazine: Bruce Hedin, Sara Bedell, Bill Heydolph, and Tedd Cluff.

The only major change was me replacing Publisher Burnett and Executive Editor Philbrick so I will be able to give *73* the direction I think you want. Mind you, it'll take a few months to get *73* the way I think it should be, but with your help we'll not only have a fun magazine to read, but we may be able to get our hobby growing again—something it hasn't done much of for over twenty years.

It takes an enormous amount of work by a lot of people to get you *73* every month. We're all working for you—to help make amateur radio more fun for you. It's you who write the articles we publish. It's you who subscribes—and remember most of your subscription money goes to our beloved postal service. It's you who buy the ham gear and services advertised in *73*, and it's these ads which pay most of the freight. If you buy more, we are able to sell more ads and bring you a fatter magazine. If you don't buy, all you get is a lousy pamphlet. It's you who urge your friends and fellow ham club members to subscribe, thus helping *73* to grow. All I can do is sort out the articles I think you'll want to read and write editorials you'll enjoy... or hate. My basic goal in life is to educate, so you'll find my editorials make you think—and you'll find plenty of articles aimed at helping you understand our fast moving technology.

Yes, I know about those old curmudgeons who hate Wayne Green. There will always be a few people who don't want to think... don't want to learn... who hate change. They're always going to find me disturbing. But I'll bet you find them as miserable to deal with as I do... as even their family does.

I have a psychological problem you have to deal with. So you might as well recognize it. This is my drive to get others to enjoy the

things I enjoy. Whenever I find something fun to do, I'm right out there doing my best to get others to join me in the fun. That's one of the reasons I started *Byte* magazine ten years ago. That's why I was such a nudge about FM and repeaters 17 years ago. That's one of the reasons I started *Digital Audio* magazine. That's why I'm trying to organize a yearly DXpedition. Heck, that's what got me into ham publishing in the first place, 35 years ago... and pushed SSB so hard 30 years ago.

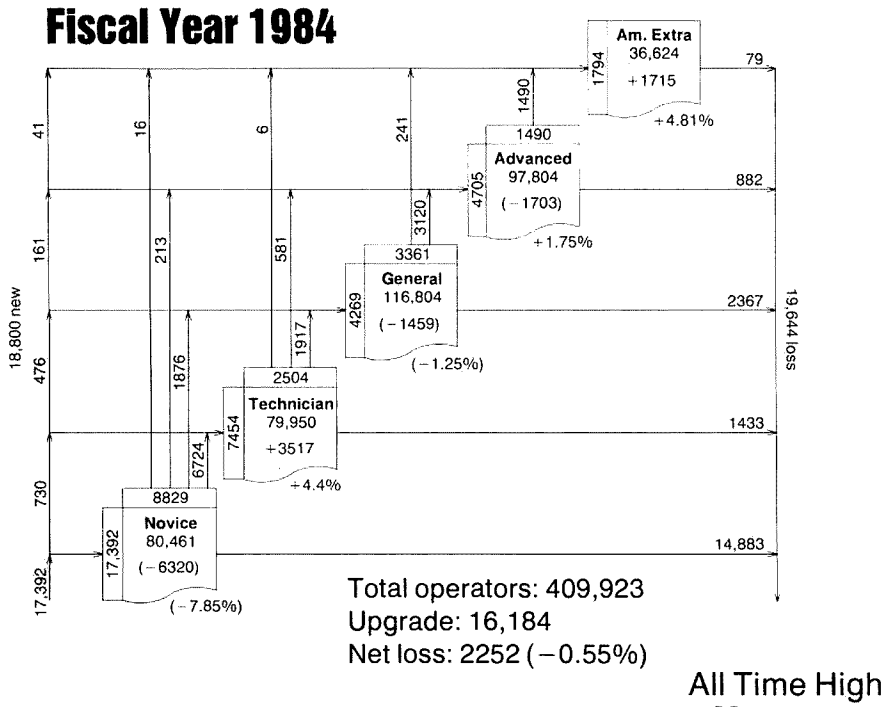
I was having such a ball with ham Teletype that I wanted to get others to try it and see how much fun it was. You know, hundreds of thousands of people are doing almost the same thing today with the computer bulletin boards and networks. They're sitting there, hooked by the phone wires, talking with each other. If word ever leaks out that they can do the same thing for free via amateur radio, we could be inundated.

I got interested in RTTY back in 1948 and took to it immediately. I found that communications via a keyboard made for much more interesting conversations than most CW or phone contacts. It takes a little longer when you type, but it also somehow brings out a lot of a person's personality. I found many hams who were deadly bores on phone to be clever and thoughtful on RTTY. The computer network users are finding the same thing today—as are the packet radio fanatics.

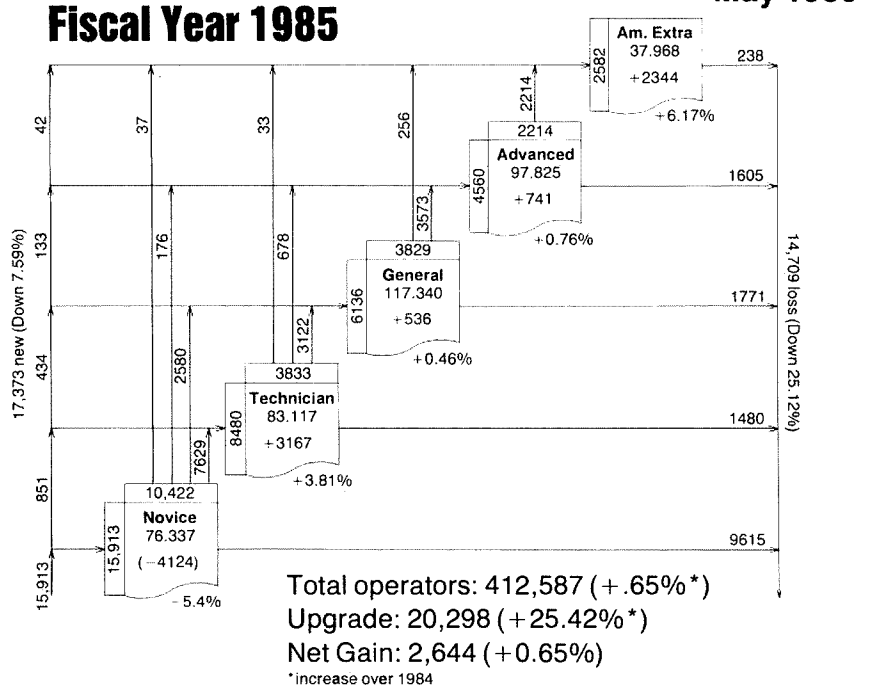
Say, if you've got a C-64 computer you might want to try one of these land-line nets and see how they work. I visited the people at Playnet the other day. Their system allows people to gather in small groups—up to six usually—and talk via their C-64 computers with each other. No restraints. If you'd like to give this a try, let me know and I'll send you the operating package, complete with disks, for $20. You could do worse than get involved and start getting the others on the net interested in hamming.

Playnet uses digital phone lines instead of voice quality, so it's a lot cheaper to use than regular phone calls. Let me know how you do. Also, let me know if this doesn't push you over the edge into packet radio.

Send a $20 check or your credit card number and expiration to me and I'll get you the Playnet package pronto. You do have to have a Commodore C-64 computer.



All Time High
May 1983



Amateur statistics for FY 1984 and 1985.

THE FCC FIGURES COVER-UP

Why some ham publishers go out of their way to cover up the licensing disaster is difficult to understand. The miserable fact is that the number of new hams licensed in 1985 was down from 1984—which was down from 1983.

If you'll check the FCC licensing charts published here you'll see that the number of Novices licensed in 1985 was down 8.5%! This is even worse than the 1984 drop of 7.9%. The situation is not getting better.

The slight increase in the total number of licensed hams (0.65%) was due to a small decrease in the number of Novice dropouts—due in turn to the effect of longer licensing terms.

If you're a fan of emphasizing the shreds of good news amongst the bad, you'll see 15% more Novices upgraded than in 1984. This helped push the total number of Novices down by 5.2% (despite the decrease in Novice dropouts, which buoyed up the Novice total). The dead-end Technician class "surged" ahead by 3.9%, while the General and Advanced classes hardly changed.

It is difficult to put a good face on what's been happening. I suppose the positive way to look at it is to rejoice that QRM will continually decrease as the *QST* "Silent Keys" column gradually eats its way through the U.S. *Callbook*. We'd better start brainstorming every way we can think of to get our hobby into gear.

The activity in Japan may be enough to keep the ITU from gradually paring down the ham bands. As the U.S. activity dwindles, the Japanese are picking it up. I wish I could get someone to translate some of the articles I'm seeing in the Japanese ham magazines. They're building all sorts of great gadgets there. Their magazines are packed with construction projects and pioneering ideas. I've got some friends there; I'll see what I can do. Of course, since we're building less these days it's difficult to get parts. Maybe we can get someone to start importing parts. If you ever get to Tokyo you don't want to miss the Akihabara section, where there are hundreds of stores selling electronic parts and gadgets. It's ham heaven—swarming with thousands of Japanese youngsters shopping for parts. Maybe someone could build a mail-order parts business here if we can get youngsters back into amateur radio.

Speaking of youngsters, a survey of the ages of the newcomers last year showed that 16% were teenagers, down from the 75% we had in the 1950s. To put that into comparative terms, we used to generate about 12,500 high-tech-career youngsters a year and now we're providing about 2,200—about 18% of what we did a generation ago. 'Tain't much.

How are you doing on getting youngsters into your ham club these days? If you're having any success, how about writing the details so I can pass them on for other clubs? Also, if you have any success in convincing youngsters to learn the code, please let me know how you did that. Most kids I've met recently think the code is stupid and those who argue for it are obviously brain damaged. Maybe it's really true that rf can cause serious mental problems.

I personally used to love the code. I adored it. I grew to love it when my Morse-code tapes were selling a couple thousand a month at $5.00 each. I think I'll make a new set of tapes and fall in love all over again. So let's keep that old code test in there so I can make plenty of money with my tapes, okay?

I won't tell you which of the ham magazines is selling the worst code tapes in the world. Scientific studies have clearly shown the enormous differences in code learning methods. The worst possible way to try and learn the code is one which a certain organization has been pushing for years. I used their system and managed to take a couple years to learn the code their way. Now days many people are learning it in a day or two—some in a few hours, using the new, modern, scientifically researched system.

Hint: This is essentially the same learning system I used with the code tapes I made ten years ago. One key element is to send each character at 13 wpm, even if you only want to copy 5 wpm. That way you train your brain to recognize the sound pattern of a character just once and you don't run into the speed plateau which I suspect has kept more people from getting ham tickets than have succeeded.

A few tests have been made with people starting to learn code at 20 wpm right off the bat. The early results seem to indicate it is no more difficult to learn 20 wpm than 13 wpm—hardly takes any longer. The main problem with 5-wpm code is the temptation to set up a table in your mind and look up each character as you hear it. Dah-dih-dah-dah, hmmm, oh yes, that's a Y. You can do this up to about 10 wpm; then the speed limit for shuffling data manually in your brain is reached and you're stranded up the well-known creek which runs from the code plateau. If you start out at 13 or 20 wpm you never see the plateau and the only paddle you need is on your speed key.

Maybe the ARRL was right when they were fighting the Novice license proposal years ago—but for the wrong reasons. It may be that the 5-wpm code test has hurt amateur radio more than it's helped. The League sure hated the idea of the Novice license, though they fought it because they hadn't proposed it and they were busy trying to keep total control of the rule changes—as they had had for many years before that.

George Sterling W1AE was the FCC chairman and he was bound he was going to get amateur radio to progress, no matter how hard the ARRL's general manager Budlong fought. George prevailed, so we got our Novice- and Technician-class licenses. As a matter of fact, for several years the ARRL lost every petition they put in for rule changes—and fought every single one they didn't put in. That perhaps made up for the earlier years when the ARRL virtually wrote all the ham rules.

I remember when I became editor of *CQ* in 1955. I visited the FCC Amateur Division and was told that Budlong had been asked to never show his face there again. The ARRL's Washington counsel, Segal (no call), was just as popular there. Oh, that's enough reminiscing. But I'll bet few old-timers had any idea of what was really going on between the League and the FCC—any more than they do today. Hint: The no-code debacle put a very heavy strain on ARRL/FCC relations, as also did the VEC situation.

Vic Clark, the previous ARRL president, and I got pretty close as a result of our work together on the FCC's Long Range Planning Committee. He was almost as upset as the FCC over the no-code disaster and complained bitterly about the room-temperature IQ of some ARRL directors he had to work with.

I have confidence in David Sumner, the present general manager. No, by golly, they've done away with the general manager title and David is the executive vice president. I wonder what the difference is? Anyway, he's a nice chap and has my confidence, as does Chris Imlay, whom I worked with a few years ago when we were both on the FCC's National Industry Advisory Committee for amateur radio. Things may be looking up.

I used to know everyone at ARRL HQ very well, but as I'm sure you've read in *The W5YI Report*, things got pretty bad for a while, so just about all the old hands quit. There was even talk of an employee union. You know, it may be getting time to restructure the ARRL and bring it up to date. It hasn't changed much in the 50 years I've know it—and I've been a member for 48 years. Both the ARRL and amateur radio would benefit if the League were brought into the 80s.

Imagine what our country would be like if we were trying to run it with nothing but sixty-year-old laws. Yes, Hiram Percy Maxim, the chap who founded the League and set it up in its present form, was a genius, but the world—and amateur radio—has changed a good deal since he died fifty years ago. Percy was also an automobile and film pioneer. I wish I'd known him.

Why do I write so much about the League? Well, they're there—and they're interesting. Also, it isn't possible to write about amateur radio and *not* write about the League. It's like writing about the United States and not mentioning the government.

I often get accused of hating the League. If you run into anyone who has that impression please ask 'em where in the devil they got such a weird idea. I've never hated the ARRL. Never loved 'em either. I try to be pragmatic, taking 'em to task when they seem to be screwing up—complimenting 'em when they do something right. Somehow my compliments seem to fall on blind eyes.

You know, when I take the FCC to task I never hear anyone beefing that I hate the FCC, yet I've been on their case far more than the ARRL. I reserve the right to be sarcastic and snide about the FCC, the ARRL, lids, the QCWA, the OOTC, and any other group which I think needs a good hotfoot for some reason.

KEEP THOSE...

Attention DXers: In case you're ever looking for something to talk about when you manage to snag a ham in a rarer country, how about suggesting they send reports now and then to the *"73* International" section? There are all sorts of things we're interested in knowing. For instance, a lot of us travel, so we're interested in knowing how we can go about getting permission to operate. . . the details. If there is a local ham club we'd like to know who to contact so we might meet with them. News of any DXpeditions, even to neighboring countries, is of interest. Contests, certificates, how many active hams there are, how difficult ham gear is to get, repeaters and their frequencies, sked times for really rare countries. . . you get the picture.

We've been getting reports from 55 countries so far in the *"73* International" section—I'd prefer reports from 300 or so. No, not every month, perhaps quarterly unless there is some special news we should know about. We need to know about special DX operations early since it takes about three months for information to be set in type, printed, mailed and then be delivered.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

FLORIDA QSO PARTY

Contest Periods:
1400 to 1900 UTC May 3
0001 to 0500 UTC May 4
1500 to 2300 UTC May 4

This is the 20th annual Florida QSO Party, sponsored by *Florida Skip*. All amateurs worldwide are eligible and invited to participate. All amateur bands may be used, 160 through 2 meters. All stations will separate phone and CW logs; phone and CW are separate contests. A station may be worked once on each band on each mode. Neither crossband nor crossmode contacts will count for contest credit. Florida stations may work other Florida stations, but for contest points only. Out-of-state stations may not work each other for contest credit. Contacts made on repeaters do not count for credit.

Florida stations will be divided into two classes. Class-A stations are those operating portable or mobile on emergency power and running 100 Watts or less output inside Florida but outside of their home counties. Class-B stations are all other stations operating in Florida. Entrants may be single operator or multi-operator, and this must be indicated on the summary sheet.

Each entrant agrees to be bound by the provisions of the contest announcement, the regulations of the applicable licensing authority, and decisions of the *Florida Skip* Contest Committee, which are final.

EXCHANGE:

Florida stations send RS(T) and county of operation. Others send RS(T) and U.S. state, Canadian province/territory, or country.

FREQUENCIES:

Phone—3.945, 14.279, 21.379, and 28.579.

CW—3.555, 7.055, 14.055, 21.055, and 28.055.

SCORING:

Florida stations count one point per QSO with out-of-state or other Florida stations. Multiplier is the sum of states (49 maximum), provinces/territories (12 maximum), and DX countries (27 maximum) actually worked. Note that the maximum multiplier is 88. Florida Class-A stations only: multiply final score by 1.5 to obtain total score. Others count 2 points per QSO with each Florida station. Multiplier is the number of different Florida counties worked (67 maximum). Final score is the product QSO points and the multiplier.

AWARDS:

Certificates for phone and CW to the top single-operator score in each state, province, territory, DX country, and each Florida county. Multi-operator winners will receive certificates as activity justifies. There are also 5 plaques to be awarded as follows: high single operator in Florida and out-of-state, CW and phone; and to the Florida club with the highest aggregate score. There is no minimum number of contacts to be eligible for a certificate.

ENTRIES:

Phone and CW entries are to be separated! Along with legible logs in chronological order, a summary sheet is required with each entry. Those with 200 QSOs or more must supply a dupe sheet. The summary sheet must contain claimed score, Florida county or state operated from, number of QSOs, multiplier total, station callsign, entry class, and power source for Class-A entries. The name of the Florida club for which aggregate total credit is being assigned must also be on the summary sheet. A signed declaration that rules and regulations have been observed must also be included. Sample summary and log sheets are available for an SASE from the QTH below.

At the discretion of the contest committee, stations and/or operators may be disqualified for improper reporting, excessive dupes, errors in multiplier lists, unreadable logs, obvious cheating, etc. All entries must be received on or before June 6. Mail all entries to: *Florida Skip* Contest Committee, North Florida Amateur Radio Society, PO Box 9673, Jacksonville FL 32208.

ARRL VHF/UHF SPRING SPRINTS

May 8—1296 MHz
May 17—50 MHz

Each sprint runs from 7 p.m. to 11 p.m. local time. These contests are sponsored by the ARRL; each is a separate event and are single operator only.

Retransmitting either or both stations or use of repeater frequencies is not permitted. Only recognized simplex frequencies may be used. Contest entrants may not transmit on repeaters or repeater frequencies for the purpose of soliciting contacts. Use of the national calling frequencies is also prohibited.

Stations are allowed only one transmitted signal at any given time. A transmitter used to contact one or more stations may not be used subsequently under any other callsign during the contest—except for family stations for which more than callsign is assigned to one location by FCC, DOC, etc.

EXCHANGE:

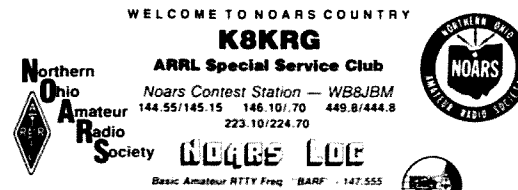
Grid-square locators (see January, 1983, *QST*, page 49); signal reports are optional.

SCORING:

Count one point per valid QSO and multiply QSO points by the

CALENDAR

May 3–4	Florida QSO Party
May 8	ARRL 1296-MHz Sprint
May 17	ARRL 50-MHz Sprint
May 17–18	ARI Italian International Contest
May 17–19	Michigan QSO Party
May 27–28	CLARA Ac/Dc Mystery Contest
May 31–Jun 1	National 6-Meter Invitational Net Activity Day Contest
Jun 14–15	ARRL VHF QSO Party
Jun 28–29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12–13	IARU Radiosport Championship
Aug 2–3	ARRL UHF Contest
Aug 16–17	New Jersey QSO Party
Sep 13–14	ARRL VHF QSO Party
Oct 11–12	Rio CW DX Party
Nov 1–2	ARRL Sweepstakes—CW
Nov 15–16	ARRL Sweepstakes—Phone
Dec 5–7	ARRL 160-Meter Contest
Dec 13–14	ARRL 10-Meter Contest



NEWSLETTER OF THE MONTH

One of the most consistently excellent newsletters we've seen over the past few years is the *NOARS Log*, journal of the Northern Ohio Amateur Radio Society.

NOARS is a large club with a high level of participation, and the pages of the Log chronicle the varied activities of the members in an easy-to-read style. Each issue is packed with useful information, making the Log almost a monthly reference manual!

Congratulations to Editor Bill Heitzenrater N8DSG and NOARS President George Morningstar W8ANM for their model publication.

To enter your newsletter in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Newsletter of the Month.

number of different grid squares worked for final score. For a valid QSO to occur, callsigns and grid-square locators must be exchanged and acknowledged. A station may be worked for credit only once per band regardless of mode. Crossband QSOs do not count.

ENTRIES:

Entries for each contest must be postmarked by June 20th. Remember, each contest is separate; use separate envelopes for each contest. Submit separate log and summary sheets for each contest entered. Logs must indicate time, callsign, and complete exchange for each valid QSO. Multipliers must be clearly marked in the log. Include dupe sheets with entries of more than 100 QSOs. Use the official entry forms, available from ARRL HQ for an SASE.

Each entrant agrees to be bound by the provisions as well as the intent of the published rules, the regulations of his or her licensing authority, and the decisions of the ARRL Awards Committee. Usual disqualification rules apply. See *QST* for any last-minute rule changes. All entries and form requests should be addressed to ARRL, 225 Main Street, Newington CT 06111.

MICHIGAN QSO PARTY
Contest Periods:
1800 UTC May 17
to 0300 UTC May 18
1100 UTC May 18
to 0200 UTC May 19

This year's QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable/mobiles may be counted as new contacts each time they change counties.

EXCHANGE:

RS(T), QSO number, QTH as state, Michigan county, or country.

FREQUENCIES:

Phone—1.815, 3.905, 7.280, 14.280, 21.380, and 28.580

CW—1.810, 3.540, 3.725, 7.035, 7.125, 14.035, 21.035, 21.125, 28.035, and 28.125

VHF—50.125, 145.025, and 146.52.

SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO, 2 points per CW QSO, 5 points for each W8MB contact, and multiply QSO points by the total number of states, countries, and Michigan counties. KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO, 2 points per CW QSO, and 5 points for each club station contact with W8MB. Maximum multiplier is 83.

VHF-only entries: same as above except multipliers per VHF band are added together for total multiplier. No repeater contacts are allowed.

AWARDS:

Plaques to Michigan entries are high multi-operator/single-transmitter score, high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score, high VHF-only (100 QSOs minimum), and high Michigan mobile. Certificates to high score in each Michigan county with a minimum of 50 QSOs. Out-of-state plaque and certificates for high score in each state and country.

ENTRIES:

A log and summary sheet is requested showing the scoring and other pertinent information, name and address in *block letters*, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated.

Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the Contest Committee are final. Results will be final on July 30th and will be mailed to all entries. Mailing deadline is July 1 to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

Michigan Achievement Award

This will be the 28th year that hams have had their own program to publicize Michigan and its products. Just as in past years, the governor will award Achievement Certificates to hams who take part in telling the world of Michigan's unlimited resources, opportunities, and advantages. Certificates are awarded on the following bases:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made with out-of-state or DX hams in which information regarding Michigan was passed.

2. An out-of-state ham (including Canada) submits log information and names and addresses (if possible) of at least 5 Michigan hams who relate facts to him about Michigan.

3. A foreign ham (excluding residents of Canada) submits the call letters and name/address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 17–24, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to Governor James Blanchard, Lansing MI 48902, U.S.A.

ARI ITALIAN
INTERNATIONAL CONTEST
Starts: 1600 UTC May 17
Ends: 1600 UTC May 18

The object of this contest is for worldwide amateurs to contact Italian stations, including San Marino, Vatican City and SMOM. Use all bands 160 through 10 meters. Operator classes include: single operator CW, SSB or mixed modes, multi-operator single transmitter, and SWL. Multi-operator stations can use both CW and SSB.

EXCHANGE:

RS(T) plus QSO number starting with 001. Italian stations will send a two-letter province instead of the QSO number.

SCORING:

European stations count 2 points for each QSO with an Italian station. Others count 4 points per Italian QSO. The same station can be contacted on the same band once on CW and once on SSB.

Count one multiplier for every province per band. San Marino, SMOM, and Vatican City are additional multipliers. Final score is the sum of QSO points from all bands times the sum of the multipliers from all bands.

AWARDS:

A special award will be issued to the top 5 of every class of participation. A certificate will be awarded to the top scoring operators in each country and for each category. The WAIP (Worked All Italian Provinces) is issued to all amateurs for contacts with 60 different provinces. This will be issued upon a written application in the log, and a separate list of QSOs for the award. Only for contest QSOs, QSLs are not required. The cost to the WAIP award is 10 IRCs.

ENTRIES:

Logs must contain date/time in UTC, band, mode, call sent/received score and new multiplier. Use separate logs for each band. Include a summary sheet with your callsign, call of participation, QSO points and multipliers on each band, and final score. Usual declaration that rules of the contest has been followed is also required. Don't forget your full address, rig description, and comments.

Logs must be mailed within 40 days from the end of the contest to: Giorgio Beretta I2VXJ, Via Sciesa 24, 20135 Milano, Italy, or addressed to: Contest Manager, c/o ARI, Via Scarlatti 31, 20124 Milano, Italy. Any logs without a summary sheet and declared score will be used as a check log. A declared score of 5% more than the actual score means disqualification.

CLARA AC/DC
"MYSTERY" CONTEST
Starts: 1800 UTC May 27
Ends: 0800 UTC May 28

The contest is open to all YL and OM amateurs. Each CLARA station may be worked twice, once on CW and once on phone, or same mode on two different bands. All contacts must be made in accordance with operator and station license regulations. No net or list operations, no crossmode contacts, no 10- or 2-meter repeater contacts. Three unidentified "Mystery" stations will be operating during the contest.

EXCHANGE:

Name, serial number starting with 001, RS(T), QTH, and if a CLARA member.

FREQUENCIES:

Phone—3.755, 3.900, 14.160, 14.280, 21.300, 28.488, and 28.588.

CW—3.690, 7.035, 14.035, 21.035, and 28.035.

SCORING:

For the base score, CLARA members score 1 point per contact with nonmembers (whether OM or YL), 2 points per contact with CLARA members, and 3 points for each CW contact. Non-

members score 2 points for each CLARA contact, 3 points for CW contacts. All multiply the base score points by the number of Canadian provinces/territories worked for the total score. The contest manager will add 10 points to the base score of each log for every Mystery station contacted.

AWARDS:

CLARA members are eligible for the 1st place CLARA cup and certificate or the 2nd place certificate. Nonmembers will receive a plaque for 1st place, and certificates for 2nd place and 1st DX. All logs submitted are eligible for the mini-prize drawing as well.

ENTRIES:

Single log entry with logs showing date/time (GMT), band, mode, callsign worked, report and serial number sent, report and serial number received, name of operator of station worked, QTH, and points claimed. Logs must be signed and show full name, callsign and address of operator, and final score (points claimed not including mystery stations). Logs must be legible, no carbon copies, and no logs will be returned. Decisions of the contest manager will be final. Logs must be received by the contest manager before July 15th. Address entries to: Muriel Foisy VE7LQH, RR#1, Pender Island, BC, Canada V0N 2M0.

NATIONAL 6-METER INVITATIONAL NET (SIN) ACTIVITY DAY CONTEST
Starts: 1400 UTC May 31
Ends: 2400 UTC June 1

All 6-meter ops invited to enter.

EXCHANGE:

Call, SIN # and grid square.

SCORING:

SIN member QSOs count 3 points, non-SIN members count 2 points. Multiply grid squares by points received for total score.

ENTRIES AND AWARDS:

Certificates issued to three highest scores and one lowest score. Send contest logs by July 1st to Lisa Lowell, KA0NNO, POB 249, Ft. Lupton CO 80621.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

COPYING THE MAIL

The biggest kick I get out of doing the annual "FUN!" poll is reading the comments nearly everyone adds to their response forms. To call hams an opinionated lot would be to understate the situation!

Lack of space usually prohibits printing more than a handful of remarks at the end of the yearly results, so this time around I'd like to dedicate an entire column to our readers' view of ham radio.

In many ways, I find the comments more illuminating than the raw statistical data. The numbers tell part of the story, showing how many hams think one way or the other on a particular issue. But data don't express the human side of the hobby—the hams who feel stymied by a lack of leadership or those who fear for the hobby's future.

Next month we'll bring you the data. For now, let's take a look at the emotions.

Here's a representative sample of what you had to say:

This was lots of fun—KD8VU
That was the idea.

To say that I cannot operate in a particular range of the ham radio spectrum is, and shall always be, in my opinion, a blatant violation of my personal rights under the first amendment of the U.S. Constitution under the subheading of free speech. It could also constitute a violation of my "civil rights" as well—WA2RCB
Right. And not allowing me to drive my Corvette at 140 mph down the Long Island Expressway violates my rights, too. Ain't government something else?

What happened to the fun questions about gay nets or pocket protectors?—KA9NZI
The humor wears off after a few years. Sort of the same reason why I stopped reading QST.

The FCC puts fear in most people. I have never heard of a ham being afraid of another ham. It's 6:20 am here. I just talked to one of those do-gooder hams. . . he says I should be on the air making contacts, not writing a letter that will end up never being read!—KA9LNT
I'm afraid of W1AW, but only on October 31. Tell your buddy he's wrong.

Amateur radio must advertise if it wants younger people to join. Make ham radio known.
Were you thinking of placing ads in Modern Maturity *or* Casket and Sunnyside?

When they market a machine with the features of the Amiga, the popularity and reliability of the IBM/XT/AT, and sell it for $1,000, I'll buy it.—WB3JYF
And when they market a car with the features of a Corvette and the popularity and reliability of a Cadillac Eldorado, and sell it for $5,000, I'll drive it!

I see learning the code [as] a way to keep the CBers off the ham bands (some still get in); anyone really wanting to become a ham can study and learn the code and earn their license.—KA7PRR
I guess I'm one of those little devils who snuck in (ex-KBX-8669).

John—how about trying some questions on weak signal VHF/UHF stuff?—Anonymous
I would have, but I didn't have the energy.

I kind of resent the word amateur, but, then again, that is the only way that there can be a differential between commercial and nonprofit radio operation.—KK2W
There's nothing wrong with being an amateur, OM. An amateur is motivated by love, not mere money. A true amateur never purposely does shoddy work. Can the same be said for professionals?

I am returning to the hobby after a 30 year absence. Things have changed somewhat.—KB6HYK
Yeah, we're all a lot older.

For someone having technical interests, finding a rewarding and interesting QSO can be hard. I helped to write MCI Mail. Hope you like it. Also, contests have got to go.—KC3NG
I like MCI Mail and use it at least two or three times a week to mail manuscripts to editors. Good job. As far as contests go, let's attack 40 meters with flaming torches during SS weekend.

Plan to buy home computer soon, but not for radio use.—Anonymous
I know what you mean, computers make lousy radios. However, the old TRS-80 Model I was so badly shielded it worked fine as a transmitter.

I feel the ARRL is doing a good job in lieu of an effective FCC.—N0EON
Uh-huh. And I feel that a broken light bulb does a good job in lieu of an effective 6146B.

Contesting should be limited to certain segments of the bands.—Anonymous
Yeah, 900 GHz and up.

Don't let computers scare you. Kids will still take interest in ham radio.—KL7GID
Computers don't scare me. I make my living writing about them. It's the people selling them that make my hair (what's left of it) stand on end.

Question 50 is ghoulish and unwanted! I'm conservative and enjoy rock music. How do you categorize me?—Anonymous
Ghoulish and unwanted.

Why did you print most of the questions to this poll on the other side of [the] page. I had to flip this damn page 37 times! Bet you lost quite a few potential responders because of this.—K1DOW/4
Yeah, guess I lost all of the readers with weak arms. CW will do that to you.

Yes, I wear a pocket saver. VE program stinks. *73 Magazine* downhill without Wayne. New calls stink. ARRL detriment to amateur radio.—K3PLV
But how about an opinion?

Be sure ARRL gets a copy of your final numbers.—K4YTB
I think they have a subscription.

I think the students at Junior High School #22 should stop begging for equipment.—K7ERN
Do you know how much money the NYC Board of Education spends on ham radio? Close your eyes and you'll have a rough estimate. Instead of griping, you should send your unwanted gear to WB2JKJ or to your local school. Make an investment in our future.

I think the last two questions are slightly unfair. If I heard an emergency net in progress, I would listen first to determine if I could be of help or would hinder the operating. As a member of ARES I get plenty of opportunity to offer my "skills" for community service.—KC7NA
Slightly unfair, but FUN!, right?

Could you send results—prepublication—of this annual event?—WA2OVG
That would be cheating, Hank. How much will you pay me?

Will be interested in seeing your tabulation.—K0GP
Next month, OM

NK6K > PACKET

Harold Price NK6K
1211 Ford Ave.
Redondo Beach CA 90278

Starting with this issue, 73 is proud to add Harold Price NK6K to our growing list of specialists.

Harold has been active in the field of amateur packet radio since early 1982. Starting with home-brew hardware, software, and protocols, he switched over to the AX.25 protocol when it was first announced as a standard in October 1982. He was one half of the first on-the-air two-way contact using the AX.25 protocol. He was also part of the three-person team that developed the software used on the TAPR TNC-1.

He was part of the early packet experiments on the OSCAR-10 spacecraft. He worked on the US/Canada hardware and software team that supplied the Digital Communications Experiment for the UoSAT-OSCAR 11 spacecraft. He assisted in final launch preparations and has continued to develop new software for the orbiting spacecraft. He is project manager for the PACSAT satellite.

Harold has authored many articles on amateur packet radio, including several that were published in non-amateur magazines. He is a regular speaker at both local and national amateur gatherings, as well as at non-ham conventions and meetings for the IEEE, computer shows, and the broadcasting industry. He is active in southern California band-planning efforts and in local packet activities.

Harold is on the board of directors of TAPR and AMSAT, and serves on the ARRL Ad Hoc Digital Communications Committee. Professionally, Harold is a computer and communications consultant.—Ed.

Welcome to the new packet-radio column! Before we start, I'd like to try something, so please bear with me.

I don't always agree with Wayne Green. The ARRL has done a lot to further the development of packet radio.

If there were fewer than two sentences in the above paragraph, then you'll know that Perry Donham was less than honest when he talked me into doing this column. In fact, if this whole introduction is missing, you'll know he fudged on the additional promise that I could be irreverent!

While we're on the subject of honesty, I should say that I live in that great non-federally-funded anthropological and sociological experiment called southern California. Therefore, any warped views should be regarded as environmental and not hereditary, so don't blame my Dad N3ECV.

Next, this column is a "conducted column," not a "written" one. That means this is a participatory venture—you are requested to write to me with news, thoughts, comments, and gripes. Only write if you agree with me, though; if you want to disagree with someone, write to Wayne.

That said, let's get to it. The subject is packet radio and other high-speed digital communications techniques. As of this writing I'm a member of three bodies that should interest you if you're interested in packet radio. I'm on the board of directors of the Tucson Amateur Radio Corporation (TAPR), the board of directors of the Radio Amateur Satellite Corporation (AMSAT), and I'm a member of the ARRL Ad Hoc Digital Communications committee. That means I'm in a position to hear some interesting things about what's going on in packet, things that I'll pass on to you. It also means that I can pass your thoughts on packet to the decision makers of the organizations that are actively involved in the development of packet radio. Even if you disagree with me, I'll pass your comments on... grudgingly.

Terms

You'll find that the term "packet" is in danger of becoming a generic term for any high-speed amateur digital communications technique. It is actually only a subset of the possibilities. Packet is a technique of breaking information down into small pieces, appropriately called "packets." The act of passing these pieces around in interesting ways is called "packet switching." There are other ways to pass information around in digital form, but few if any have been implemented on amateur radio yet. Hopefully, the next few years will see digital voice, digital video, and other high-speed digital forms of communications come into use. This column will "limit" itself to digital communications, excluding CW, RTTY, and AMTOR, as these three modes are adequately covered elsewhere.

Packet Introduction

I don't have much room left over this month to give a full introduction to packet radio. Besides, that could be a little dull, so we'll do the training a little bit each month. In case you've never heard about packet before, here's a real short introduction:

Packet is a method of sending information over amateur radio, just as spark, CW, AM, SSB, FM, RTTY, AMTOR, SSTV, and FSTV have done down through the years, but with two major differences. Packet provides for "perfect" information transfer, and it permits multiple simultaneous contacts on the same frequency. It is "perfect" because packet uses computers and a complex method to check each piece of information to see if it was received correctly. Packet procedures ensure that a packet is retransmitted until it is received correctly. Packet can share a frequency because information from any one station is broken into small pieces. These pieces can then be mixed in with pieces from other stations on a single frequency. Because each packet is tagged with the callsigns of the sending and receiving stations, each station can keep track of which packets are for it.

The device used to "do" packet radio is called a Terminal Node Controller (TNC). This is a small interface box that goes between your radio and your terminal or computer. The microprocessor inside the TNC takes care of following all the procedures necessary to exchange data with other stations. To learn more about packet, check back in your stacks of magazines for, or borrow from a friend, the following:

Price, H., "What's This Racket About Packet" and "A Closer Look at Packet Radio," *OST*, July and August, 1985.

Johnson, L., "Join the Packet Radio Revolution," *73*, September and October, 1983, and January, 1984.

These articles contain pointers to other information sources on packet. Most larger radio stores will have a TNC on display or even operating on the air. The most common frequency in use for packet radio in North America is 145.01 MHz. We'll do a little more on packet introductory material here next month.

Packet History

Following is a capsule history of some of the aspects of packet-radio development. I have previously placed an earlier version of this history on public BBS systems, so you may have seen some of this before. But for newcomers to packet, here is the answer to the question, "How long has amateur packet radio been around?"

•September 1978: Non-baudot digital transmissions made legal in Canada. Digital experimentation begins.

•January 1979: Vancouver Amateur Digital Communications Group (VADCG) formed. This group produced the VADCG TNC, some of which are still in use today.

•Summer 1979: Work begins in Ottawa and Montreal. Total North American digital users = less than 30.

•March 1980: ASCII data legalized in the United States. Canadian missionaries armed with VADCG TNCs and software cross the border.

•December 1980: First United States digipeater goes on the air in San Francisco. It used home-brew hardware and software based on the VADCG protocol (now called V1).

•1981: First great packet diaspora begins. VADCG distributes PC boards. Home-brew systems are developed. Most areas standardize on 1200-baud Bell 202 modems, VADCG-compatible hardware, and 2-meter FM. Locally maintained software versions in San Francisco, Washington DC, Vancouver, and elsewhere begin to diverge.

•October 1982: AMSAT and AMRAD host another in a series of meetings to solve the divergence problem by developing a protocol standard. Other major goals include the desire to support more than the 32, 64, or 128 users allowed by then-current V1 implementations. The AX.25 standard is born. Total North American digital users = less than 200.

•January 1983: After several months of design and testing, the Tucson Amateur Packet Radio (TAPR) group produces 170 assembled and tested beta-test TNCs.

•October 1983: The kit version

of the TAPR TNC (now called TNC-1) is tested by 19 users.

•December 1983: 200 TNC-1 kits are shipped. In the meantime, more VADCG boards are assembled. GLB takes out its first ad in *QST* for an assembled and tested unit. Total TNCs = about 650.

•1984: TAPR begins to ship TNC-1 kits in bulk. They ship an average of 120 TNCs per month for the next 15 months. AEA announces an assembled TAPR TNC-1 clone at the Dayton Hamvention. Packet hits the big time when Lyle Johnson WA7GXD wins the Dayton Hamvention Technical Excellence Award for the TAPR TNC. He accepts on behalf of packet radio and TAPR. AEA legitimizes packet by placing the first full-page ads for packet equipment in the big ham magazines. At the end of 1984 there are more than 2500 TNCs.

•1985: Heath announces the HD-4040 TNC-1 clone kit, begins shipping in April, and sells out the first 500 in three weeks. Kantronics announces the "Packet Communicator." TAPR announces TNC-2. GLB announces PK1L. AEA announces PK-64 and PK-80. For a time in August, most of the packet industry is "sold out," with demand far exceeding production. Bulletin board systems running software designed by W0RLI begin to proliferate. "RLI" systems allow for the automatic exchange of messages between them. Messages, routed by the BBS systems, crisscross North America on a combination of HF, VHF, and UHF frequencies. Ties between the National Traffic System (NTS) and packet networks become more common. There are at least 10,000 TNCs in the field, worldwide.

•January 1986: More TNCs and TNC add-on products are announced. AEA announces an HF modem that can be added to any TNC. When an amateur group in Ester, Alaska, produces a VHF/HF mode switch for TNC-1 and TNC-2 style modems, they give their street name as "AX.25 Communications Trail." It is predicted that more than 14,000 TNCs will be in the field by March. The number of amateurs working on improvements to existing packet networks and developing new directions for the future is also increasing. A group in Hamilton, Ontario, is making an IBM PC plug-in board available. A Texas group is working on a network linking system, as is a group in Florida. TAPR is working on networking hardware and software. Networking software from New Jersey will be available soon.

1986 will see the launch of two satellites with packet radio facilities on board, Japan's JAS-1 and the international AMSAT Phase III-C. The UK's UoSat-OSCAR 11 satellite, with its American-Canadian digital store-and-forward message system, has already been tested as an international information transfer device and will see greater use in 1986. This column solicits information on these and other items for discussion in the coming months.

Prove It, Packet

In closing, I'd like to answer a letter that was printed in the December, 1985, issue of *73*, page 69, under the headline, "Prove It, Packet." It seems that the letter writer went to a hamfest where an over-zealous speaker claimed that packet would replace CW/RTTY/AMTOR. I agree with the writer when he says this won't happen. The only modulation mode that ever disappeared in amateur radio was spark gap, and you can still get a demonstration of that at many hamfests.

Thereafter, the writer and I part ways. First, he refused to believe another packet proponent at the hamfest who said packet interface units would cost less than $200 by the end of the year. Through the magic of publishing lead time, the very same issue of *73* contained several ads for packet gear that carried a list price of between $209 and $219, and retailed for just below $200. GLB announced a unit that you can almost fit in a shirt pocket, and AEA had one that does CW/RTTY/AMTOR/ASCII as well as packet for the same price.

Next, the writer doubted that packet is error-free. Well, he *can* argue the point, but Andrew S. Tanenbaum, in *Computer Networks* (Prentice-Hall, 1981), says about the same error-detection scheme used by the AX.25 packet protocol: "[it] catches all single- and double-bit errors, all errors with an odd number of bits, all burst errors of length 16 or less, 99.997% of 17-bit error bursts, and 99.998% of 18-bit and longer bursts."

Less easy-to-quantify factors in the protocol, having to do with the callsign fields, control fields, and flags, comprise a large portion of the 0.002 percent of errors that slip by. You must also compute the probability that 17 or more bits will be bad in any given packet. Then multiply all the probabilities together. The chances are less than one in a million that you will get an undetected error. As a rough guess, you would have to send 128 million characters before you stood a small chance of seeing an undetected error. Since even Ivory Soap is only 99.44 percent pure, this is close enough to error-free for most people. The reason packet data arrives error-free is that packets with detected errors are retransmitted until they are received correctly.

Packet bandwidth is discussed, but that's a subject for an entire column. The writer then mentions the transmitter keying rate. Actually, packet is efficient in terms of toggles per information passed. Packet will switch once per 80 or so characters passed in a conversational mode, or once per 400 characters when moving large files. AMTOR switches once every three characters. Full break-in CW, depending on the settings and operator habits, can switch once per word, or once per character.

Finally, the writer asks why, if only 200 Watts eirp are required to access OSCAR 10, do you always see photos of 25-foot dishes or stacked 12 over 12 arrays. Because the guys with the metal in the air like to take photos of it, that's why. Those of us with just the 10-dB-gain yagi never get around to taking the pics. I put 100 Watts into 3 dB of cable loss and a poorly made N connector, then into an 11-dBi-gain antenna. I then crank the power back until I'm no louder than the beacon.

Aside from the OSCAR 10 comment, "Prove It, Packet" is a victim of rapidly advancing technology. We've come a long way in a short time, and we've hardly gotten started. Because things have a habit of changing very rapidly, to help you keep things straight I'll include the date that I finished each column somewhere in the column. This one, for example, is 2/24/86.

Please help make this column worth the space it's taking by sending in your questions and comments. I can also be reached on CompuServe at 71635,1174, and on packet by NK6K @ KD6SQ. Next month, more stuff like this, only different.

RTTY LOOP

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Oh boy, if only you could see this! On my desk is a stack of letters from you all. Some of them have received a response in the mail, some have not, but none of them have yet reached print. So, blessed by the wonders of my word processor, which has the ability to move whole paragraphs at the touch of a single key, let's mush through this stack together.

CoCo

I hope that Lloyd Chapman W8WHA of Toledo, Ohio, is enjoying the new CoCo keyboard he got after the tip in this column. It should slip right into the CoCo II, and there are several programs around to help use the "extra" keys. One was mentioned here a few months back.

William E. Mangor VE3BOQ of Morrisburg, Ontario, relates that the quick CoCo RTTY output program in the March, 1985, "RTTY Loop" column works fine, with one problem. The CoCo printer routine assumes that the printer adds a line feed after each carriage return, whereas the teleprinter requires that a line feed be sent. He wants to know how to do this using software. Well, the "down arrow" key on the CoCo will send a line feed, but that will only help a tad. Best bet would be to put in a machine-language filter to add a line-feed character after each carriage return. I would rather not fill these columns with listings unless there is some demand for it. So let me know, and I'll be glad to print a suggestion if a bunch of you need it.

Jay Sarajian WB3BKW in Feasterville, Pennsylvania, enjoyed the patch for Clay Abrams' NEWRTYCW program published here a few months ago. He said he had to save it as "PATCH/BAS" though, instead of "PATCH.BAS"

as titled here. I don't know why, Jay, as I normally use the period rather than the slash routinely for CoCo extensions. Not only that, but (CoCo'ers take note) you can also preface the drive number (*i.e.* 1:PATCH.BAS) rather than suffix it (PATCH.BAS:1). At least you can do this with standard Radio Shack DOS version 1.0 or 1.1. If you are using ADOS it should work as well, but if you are using JDOS all bets are off, as many of the pointers and routines have been customized. Would be interested to hear the follow-up, Jay.

Jim Leischner KA9RGJ in Cisco, Illinois, is another CoCo user who is hard at work to put his computer onto RTTY. I hope the material I sent you helped, Jim. I think you will find that the CoCo is a flexible computer that will be able to do just what you want.

Same thoughts go out to Bob Hartley K2QJ of Kendall Park, New Jersey, who is also looking to put his CoCo onto RTTY. As I have indicated, Bob, the Abrams program is the only one I have seen, but that doesn't mean that there won't be something else soon. Just keep reading, right here!

Teleprinters

Carl Anderson WA6CMT of Santa Ana, California, counts himself as one of the "silent" readership who has flirted with the RTTY bug for a long time, and now hopes to interconnect a Model 32 and/or Model 33 Teletype® with his ham gear. Well, Carl, I hope that the material presented here last month helped your efforts. Let me know how it goes!

Using an Info-Tech interface, Joe Kovarik, Jr. KD9G in La Grange Park, Illinois, is looking to hook up his Model 33 as well. Again, I hope the information from last month helps, Joe. With a Model 15 on the Murray/Baudot port and a Model 33 on the ASCII port of that interface you'll have quite a station!

Not everybody is working on Model 33s, though. Mark Hines KA8TNT of Ludlow Falls, Ohio, acquired a receive-only Model 28 and would like to interface that machine on RTTY. Assuming you have loop connections, Mark, this should be trivial. Hook into the TTY loop, send it some five-level goodies, and see what prints.

C-64/VIC-20

Interest in alternative means of interfacing the Commodore 64 computer remains high, as evidenced by the note received from George Tubb W5HI in Los Alamos, New Mexico. George is looking for, among other things, interfacing other than that provided by the likes of Kantronics, MFJ, AEA, Microlog, and others mentioned here in the past. Hmm . . . sounds like a tall order to me! I print what I get, George. I know I've said this before, but if I have not written about an item, it is not because of bias, it's because I have no information to write about. Manufacturers, are you listening? Stay tuned for Chapter Two, George!

George "Keoki" Susterich KH6DXO in Hanapepe, Hawaii, is also looking to put his C-64 onto RTTY. I have sent him the ever-growing list of "RTTY Loop" reprints available, and hope that the information printed here lately helps him connect one of the teleprinters he has to the C-64 for use as a system printer.

A VIC-20 user, Michael V. Hoffman N7GLO in Eugene, Oregon, is busy building the one-chip demodulator we talked about here a few months ago. He is trying to look into Murray-to-ASCII code conversion himself. Well, Michael, there are many schemes in use to convert five level to eight level and back again, and I think that a brief look through some back issues of *73* and other magazines may turn up just what you're looking for. There are certainly a number of commercial schemes, many of which I have touched upon here, and one of them may do as well.

Michael also asked a rather fundamental question that I have not covered here in some time, so I'll throw it in now for good measure. He said that in "thinking about AFSK and SSB rigs, . . . it seems to me that what you get from AFSK modulation of SSB is the same as you get with FSK. Can you tell them apart?" No, you can't, Michael, and that is just the point. After all, if you sent one pure tone through a SSB transmitter, what you should get, assuming that the carrier is well suppressed and there are no harmonics, is one pure rf signal, offset either above or below the suppressed carrier by the absolute value of the frequency of the audio tone used to generate it. Two tones, two rf frequencies—and if you shift one tone, you get an rf signal that shifts in step and magnitude with the audio used. Now, remember this, though—the "standard" FSK convention is low space, high mark; whereas the "standard" AFSK convention is just the opposite. So if you are using an AFSK signal to generate FSK on an SSB transmitter, use *lower sideband* so that the relationship of mark and space is reversed. If this is still not clear, let me know, and I will print a few diagrams to try to straighten this whole thing out.

Apple //

Hanspeter Nafzger HB9AQZ, a Swiss amateur who says he gets hold of a copy of *73* during his extensive traveling as part of an airline crew, is having problems putting a package onto RTTY, and wonders if any of us could help. The software in question is the Radcom Plus interface and software for the Apple, and his biggest problem appears to be that when copying OSCAR-10 telemetry data, which does not use unshift-on-space, he sees rows of letters instead of figures. He is curious if anyone has experience with this software, and might have a patch or solution. If so, drop me a line here, and I will publish the answer for Hanspeter and the rest of us, too.

My understanding is that the Apple interfaces via TTL levels. So the one-chip receive circuit from July, 1985, should interface without too much problem. Arnold Bucksbaum W0WGE of Cedar Rapids, Iowa, wants to work on that circuit for his Apple. TTL is TTL, Arnold, and the 2211 scheme should hook right up. Hope to hear from you about your success.

Miscellaneous Mishegas

Richard Keusink K7VPL in Brookings, Oregon, has the distinction of having his letter lost on my desk for quite a while. Anyway, Richard is another ham having operating hitches with his AEA CP-1. It would appear that the problems being mentioned, such as the inability to load another's call without leaving the T-R mode, are just designed into the CP-1. Looks like you will have to wait for the CP-2 (hint, hint—QSL AEA?).

Richard is also looking for press signals on the HF bands. While there have been other books on the market, the Klingenfuss books mentioned here remain the most complete one seen. Complete to the tune of overkill, in fact! I don't know if I can publish spotted frequencies here, but if my editor would let me, I would be glad to pass along interesting locations on the HF spectrum. [Spot at will, Marc!—*ed.*]

Hope all this helps, Richard, and I'll pass along whatever else I get when I know more. (Boy, I say that a lot!)

Peter Schulz in Dorval, Quebec, notes that hams interested in putting a Timex/Sinclair ZX-81 may be able to use a program he knows as the NARP program, and corresponding interface. He knows no details about this combination, do any of you? Let me know, and I will print the information here for all the T/S users to benefit.

Peter is also interested in putting a TRS-80 Model 100 onto RTTY. Sorry, but I draw a blank on that one, Pete. Again, if anyone is using a Model 100, 200, or 600, let me know, and I will help to let the gang know.

Radio facsimile transmission is not that far afield from RTTY, and the WEFAX routines mentioned here a while back have whetted a few appetites. Brad Slocum in Sunnyvale, California, is very interested in receiving this type of information via computer. Well, Brad, I know that the WEFAX routine mentioned, which was written for the CoCo, uses features indigenous to that machine. I don't know of a version that runs on IBM PC type computers. If you have a CompuServe account, you might check on the CoCo SIG (GO COCO) for the WEFAX program and related data.

Ditto to David Woolweaver K5RAV, DDS, MSD of Harlingen, Texas. David is interested in receiving WEFAX with a TRS-80 Model 4. Sorry, but I have seen nothing for that computer either for WEFAX reception. The abilities of the 6809-based CoCo really do shine in that regard.

Just what is an obsolete computer? Fred Jacob W6WBT of Davis, California, is playing with the Heathkit ET-3400 computer trainer, a 6800-based single-board computer, and wants to play with RTTY on that! Well, Fred, a few years ago I printed the source listing for both receive and transmit for the 6800 that should be easy to use on the ET-3400. They are part of the "reprint series" information that I am sending him; you can get a listing, too, for a self-addressed, stamped envelope sent to me at the above address.

Roger Wells N4AHA in Lexington, Kentucky, is interested in connecting a Heath H-89 computer to a Kantronics UTU interface. As far as I know, Roger, any terminal program should do fine, and

there are many available in the public domain. If there is a local computer BBS, I am fairly sure that a terminal program will be living there. Ask around, and don't forget the folks at your local Heath store and ham clubs. Hopefully you will be able to find a serviceable program, *gratis*, without too much trouble.

Want to get some idea of the readership of *73* and this column? Just look at where some of these letters came from: every corner of the world, it seems! I never cease to be amazed at what our buddies are doing with digital communications, and I will try to share whatever I know with you all. Let me hear from you; the letter box is looking very empty about now! As always, if you would like a reply, enclose a self-addressed, stamped envelope. CompuServe subscribers can reach me there, usually on EasyPlex, via my ppn—75036,2501. Or, if you feel lazy, just kick up your feet, and wait for the next issue of *73* to see what's in the next edition of "RTTY Loop."

ABOVE AND BEYOND

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Tired of sitting around the shack waiting for the band to open? Looking for more of a challenge than just picking off grid squares with your long-boom antenna and kilowatt amplifier? Need something to put the "zip" back into VHF operation?

Have I got a remedy for you! It's time to shake the dust off your feet and head for the hills—or lakes, mountains, beaches, even the local skyscraper—and go portable. Instead of waiting for the tropo duct to open to you, go chase it down for a change. If you're still waiting to work someone from that rare grid square, why not put it on the air yourself, and make a lot of other grid chasers happy! If you're tired of fighting the "big boys" with their super stations during contests, put something together on your own and give 'em a run for their money.

The Joys of Portable

You haven't lived until you've spent an entire weekend simultaneously working sporadic-E on 6 meters while swatting mosquitos, or latching into an enormous 2-meter opening while in a storm. Or perhaps you'd enjoy the simple pleasures of watching the wildlife devour your coax, as I did.

Whatever your VHF interest, there's a way to pursue it in a portable fashion. And there's certainly no shortage of equipment around to make do with, either! Throw some stuff in a backpack, bring some food and drink, and head for the hills. Somehow the effort required to go to an out-of-the-way location and work some DX makes the contact all that much more satisfying, and you might get more exercise than you've had in a long time. All it takes is the right equipment for the job and your desire to have fun. (Note the word *fun*: interpretations of fun will vary wildly depending on how kinky you are.)

The Contest Season

As you read this, the trees are bursting forth with leaves, and temperatures are slowly rising, so the weather will be on your side soon. How convenient that there are four major contests to choose from in each of the months from June to September.

First the ARRL June VHF QSO Party comes your way. About the time you start to recover from this, the July *CQ* Worldwide VHF WPX Contest shows up. Assuming you made it so far, you can dive into the the ARRL August UHF Contest. Finally, if you're still alive, the ARRL September VHF QSO Party wraps things up. Four good contests spaced just far enough apart to make you a committed portable VHFer for life (...or to have you committed for life!).

What do you need to go portable...well, how high is up? There are those who choose to carry a simple monoband battery-operated transceiver up a nearby hill for some casual operating, using a simple quagi beam. And then there are those who practically create a self-contained mobile communications support vehicle that rivals anything the military's got to operate multiband QRO stations, using enormous antenna arrays and sophisticated transceiving equipment. It all depends on how badly you've been bitten by the bug.

I've personally been involved with several portable operations, ranging from backpacking 10-Watt stations and single yagis up a mountain to operating from several camper/trailers with generator power, in temperatures ranging from 85 plus degrees all the way down to 30 degrees and below. I've been eaten alive by black flies and drenched in a downpour, nearly blown off a tower, and had masts fall on me in high winds! On the other hand, I've also seen some spectacular views of the night sky and had plenty of time to sit alone in the dark on a hilltop comtemplating nature (and my navel, tool).

If you've ever scampered up a tall building and drove repeater owners crazy kerchunking machines miles away, then you've probably got the bug and there's no stopping it. In fact, many people find FM portable operation to be eminently satisfying, and rare is the time when a ham doesn't throw an HT into a backpack or in with camping gear. FM portable is very popular in Japan and Eastern Europe as well. In fact, these folks may have refined it to an art form. One of the entries I saw from the *CQ* VHF WPX this past year was from a JA who used a Kenwood TR-50 (1 Watt, 1260 MHz FM portable) to work over 30 stations in the 23-cm band during the contest! We're still trying to get people up on 23-cm here, and he's busy firing off QSOs like there's no tomorrow.

Other entries received from Europe indicate a strong preference for this mode, with many Romanian logs indicating the use of home-brew 2-, 3-, and 5-Watt rigs to make contacts on 144 MHz FM, as did logs from Hungary. You see, FM simplex is still a novelty over there (and with all those countries to choose from and prefixes to work it's no surprise, really) so the amateurs turn out in force with their handie-talkies.

If you want to work something more exotic, then weak-signal work is the logical choice. Usually this means SSB or CW operations, and again the Europeans are heavily into it *a la* QRD.

Apparently, the Yaesu FT-290 is very popular in many countries for this type of endeavor, and for a time it was also available here as well. For some unknown reason, Yaesu has seen fit to pull it off the market, leaving us with no currently available portable 2m SSB/CW/FM equipment for the band. A companion unit for 6 meters also bit the dust, but the 432-MHz version still lives on until stock runs out or Yaesu cans it as well. All of these radios featured 1–2 Watts output from a self-contained battery-powered package with 12 memories, dual VFO's and a nice LCD to save power.

The FT-290 is particularly nice since its power level can be dropped into the milliwatt range. This would then allow the use of outboard transverters for 432, 1296, and even 50 MHz, giving you a very flexible station with four antennas and a small battery pack for the transverters—one which could be easily backpacked to a nearby hill. My advice would be to grab one if you see it at a flea market, as there isn't any other product that will do the job nicely.

You may also come across one of the time-honored ICOM IC-502/202/402 series radios. These were made for many years by ICOM and offered the user somewhat lower sophistication than the FT series, but developed 3 Watts PEP from a self-contained battery pack on SSB, CW, and sometimes FM across the 50-MHz and 432-MHz segments, and the radios had built-in collapsible whips (not very useful when working horizontally polarized stations, but a start, anyway). There are still plenty of them around and still plenty of hams using them for lightweight portable mountaintop stations. If you think you'd like a simple setup, the ICOMs are the way to go. You can always add an outboard amplifier as needed to boost the signal, and one of these and a 10-Watt "brick" will run for hours from a small storage battery.

Other than these, the selection of portable non-FM equipment has pretty much dried up. ICOM still makes the IC-505 for 50 MHz, which is a unique 3/10-Watt portable for SSB/CW/FM, using either a built-in battery pack on low power or external source on high power. For 144-MHz SSB nuts, Santec makes the LS-202 handie-talkie with SSB and FM modes built in, running 1.5 Watts output. Now *there's* a good ques-

tion: Why aren't Japanese making multimode handie-talkies? They would sure sell like hotcakes over here! How about it, guys?

Power

The next step is to get a small generator or battery and use a mobile multimode radio, preferably one with 10 Watts of power; 25-Watt types can be used if the power can be reduced to save battery life. With a generator, it doesn't matter. I've used a Kenwood TR-9000 for some time with outboard transverters for 432 and 1296 MHz to go portable on three bands with 10 Watts. A small motorcycle battery will do the trick for a moderate amount of operating. A better idea is to disconnect the final amplifier and run the TR-9000 barefoot and to throttle back on the output of the MMT transverters, as we did at Slide Mountain last year. With a good yagi, 2–3 Watts output will get you a long way. Being able to adjust the output of SSB or CW allows the ability to go to full power to make that weak contact, and to throttle back for the close-in stuff.

The whole arrangement shouldn't weigh more than 20–30 pounds, excepting your support equipment such as tent, food, clothing, lights, and so on. We overdid it for our first trip but when I do it again (and I surely will) the weight will be optimized. After all, there's no sense in bringing such things as a wattmeter if the problems it indicates can't be repaired anyway.

About the Antennas

As you go higher in frequency, remember: a given gain figure requires less metal. It's as simple as that. You can employ a lightweight PVC pipe as masting, or superlight aluminum mast sections, predrilled to slip together easily. We opted for surplus army masting in five-foot sections that were swaged, and locked together with long #8 screws. A single yagi for each band will suffice for the small portable station, and there are some beauties to choose from. One of my personal favorites is the F9FT 21-element yagi for 432 MHz. This antenna easily breaks down into four sections and can be assembled with a spintight (8mm) or wrench. It's extremely light, weighing in at about four pounds. And it's durable, using a dipole-driven element and secure through-the-boom element construction.

F9FT also makes small high-gain yagis for 1296 as well, but these need to be mounted at the top of a metal mast, as the diameter of the mast is a significant part of the wavelength in use. Of course, a PVC mast eliminates this problem. As for the lower frequencies, Cushcraft antennas are time-honored choices for mountaintopping, especially the 11-element and older 7-element versions. KLM makes nice yagis with 4, 8, and 11 elements for 144 MHz, as well as 7- and 14-element versions for 220. On 50 MHz, both companies have usable lightweight yagis around 9–10 pounds. I'm not too familiar with the F9FT 2-meter antennas, but the CueDee from Sweden also fits the lightweight requirement nicely.

The decision you make will largely depend on weight. If you've picked a good location near population centers and run a small amount of power—say, 10 or so Watts—then 7–11 elements on 144 and 220 will do the trick; 19–21 elements will make things happen on 432, and 19–23 elements will do on 1296. Keeping the elements to a minimum will reduce gain as well as size and weight, and will allow more antennas for other bands. One operation I participated in was from a fire tower in western New Jersey.

We ran 10 Watts on 144 and 432 MHz using a TR-9000 and Echo 70, respectively, feeding 11 elements on 2 meters and 16 elements on 70 cm (both KLM beams). This mast was a 20-foot slip-up, and everything was run from battery power in the 4WD truck we drove to the site. Had we brought a generator, we chould have run 10 times as much power, but we were limited to the truck battery. I'll tell you, the signal reports we got were amazing. Many multi-ops thought we were running kW stations! Of course, being at 1500 feet, 1200 feet above the average terrain, makes the difference.

As you might have expected, we got rained out halfway through the festivities, but still racked up some good Q totals with our simple equipment. There are plenty of mobile multimodes that lend themselves to this application, and many have the variable power output option, such as the ICOM 290 and 490. If you can throw a generator in the truck or car, then 100-Watt solid-state amplifiers will make will make the job somewhat easier for you.

Last but not least are the stations running large home-brew transmitters and receivers, or employing base-station multimode radios driving high-power tube amplifiers. A large number of contest portable stations in the United States operate in this fashion, and several hams have built entire kW stations for each band right into their truck or camper. One good example is Wayne Overbeck N6NB, of San Clemente, Calif., who has been a VHF nut for years and will travel thousands of miles to get on a hilltop and hand out a section or grid square. Wayne's small imported truck looks innocent enough from the outside, but the inside is loaded with sophisticated radios and amplifiers for 6, 2, 220, 432, and 1296. The Pack Rats (Mt. Airy VHF Radio Club) of Pennsylvania are noted for their well-equipped mobile stations which travel to as many as four or five grid squares during a contest to get on 1296, 2304, and higher. And of course the renowned W2SZ/1 group literally takes over Mt. Greylock each June and September for the ARRL QSO Parties, setting up stations into the 34-GHz and higher range.

So, there's no shortage of ideas when it comes to going portable. Want to try something really different? Go the the seashore instead of the mountains. You'll probably hook into a good tropo duct (especially in late July, August, and September) and work some unusual DX. This is becoming a favorite mode of contesters on the Eastern Seaboard of the United States. In fact, our group, SCORE, will more than likely make a stab at some sort of seaside portable operation for the ARRL June Contest, as there are plenty of grids that lie along the coast that could be activated. Best of all, they are all accessible by car or truck. And if you want to get R&R, it's off to the beach for a dip and maybe some sun. After all, all work and no play....

Remember also that portable operation is a big change for some hams who live in apartments or condominiums with restrictive antenna situations. There are plenty who break from "cabin fever" in January and head to the hilltops to run the January VHF Sweepstakes from their car with a multimode. Still others live in areas with high atmospheric or manmade noise levels, not to mention CATVI problems. I can relate to the latter, as our local system operator is pretty slow to fix leaks in the system on 2 meters and 220 MHz.

Unfortunately, the ARRL contests really don't give the small portable operator an incentive to make a serious run of it. This is a problem that really ought to be looked into, as it is somewhat ridiculous for a single operator with 10 Watts on 6 and 2 to be put in the same class with a high-powered multiband station on another hilltop—kind of like running the 100-yard dash against a Ferrari. On the other hand, the *CQ* VHF WPX does offer awards classes for the small guy, with QRP entries in the Single Operator, Single Band and Single Operator, Multiband categories. There is also a separate category for portable operation. Now the hilltops with their FT-290s are butting heads with each other, not some kW staton with multiple yagis.

Based on the returned logs, these classes are proving to be very popular. The U.S. winner in the portable category ran his jeep up a ravine in Nevada and nearly got in a washout, but still managed to make many contacts on 6 and 2 meters. This was also a popular class in Romania and Hungary. In fact, the top overall score in the world—F6KAW/P, with 1347 QSOs and 158 prefixes—was made by a bunch of guys running a pair of stacked F9FT beams on 144 MHz with 300 Watts of power. Imagine that—and they worked 85 grid squares in one weekend. If that isn't a good enough reason to try some portable operation, then I can't think of any others.

From the Mailbag

Ted Reinke KA7MNZ writes in with a queston about OSCAR operation that has been raised before. It pertains to operating full duplex with a single HF radio, which is of course not possible unless the radio is heavily modified. You'll still have to use two separate radios—one on 145 MHz and another on 435 MHz—to be able to hear your own signal back off the satellite. However, the setup need not be expensive if you go this route. All you need is a 10- or 25-Watt signal source and amplifier on 435, while a simple receiving converter into an HF radio or receiver will allow monitoring of the downlink. There are plenty of manufacturers of this type of con-

verter that advertise in this magazine.

Ten-Tec of Sieverville, Tennesse, makes an interesting unit called the 2510 OSCAR converter. Hooked up to your HF radio, it'll generate a 10-Watt signal on 435 MHz and listen at the appropriate downlink frequency on 145 MHz, using a dual-vfo system. Although not a duplex system, it saves the time spent looking for your downlink echo. All you need do is to locate the desired signal you'd like to work on 145-MHz SSB or CW and just start transmitting. The 435 uplink frequency will automatically be set.

Another question Ted raised is the use of a single twist antenna for both SSB and CW. It works fine, Ted! Several stations in my area have one antenna on both FM operation and weak-signal work. Of course, you'll have to use a noninductive mast, such as fiberglass or PVC, but you will certainly find the results well worth it. Add an elevation rotor and you can now listen to the downlink on 145 MHz. Add another twist for 435 and you'll work the uplink looking for your downlink on 145 MHz. Add another twist for 435 and you'll work the uplink, as well as weak-signal and FM stations on 430–440 MHz. A twist antenna isn't as good as an optimized long-boom yagi for either band, but it is an acceptable compromise. Just make sure that it is rated for the full frequency coverage of the desired bands. Both KLM and Cushcraft here in the U.S. make excellent twist antennas for this purpose.

Quite often you'll find the twist makes a difference on weak-signal work, since polarization of signals can shift over long distances and the twist overcomes some signal fading effects due to this phenomenon. I used one of these for some time locked into the RHC (right-hand circular) polarization mode, and I enjoyed many long-haul contacts on both SSB and CW, as well as simplex FM work.

Jan Kok WA4NZL writes from Charlotte, N.C., to inquire as to the availability of the Texas Instruments Dual-Gate GaAsFET mentioned in the December, 1985, column. Jan, I suggest you contact Kent Braitan WA5VJB through the *220 Notes* newsletter for more information. The device number is TI-S3030 and is very new to the market. The address for *220 Notes* is 308 Eastgate Circle, New Lenox IL 60451.

Let's hear from you! If you're into portable operation, send along some photos of your station and antennas, as well as any interesting stories. I'll provide more details of upcoming contests so you can plan ahead and get thee to a hilltop...See you "Above and Beyond!"

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards or odd-sized scraps of paper. Please type or print your request (neatly!, double-spaced, on an 8-1/2 x 11 sheet of paper and use upper- and lower-case letters where appropriate). Also, please make a 1 look like a 1 not an l—which could be an el or an eye, and so on. Hard as it may be to believe, we are not familiar with every piece of equipment ever manufactured on Earth! Thanks for your cooperation.

I need an owner's manual and schematic for the Tennelec Memoryscan–MS–2. I will pay for copies or will copy and return originals.

Terence J. Weil
1509 Victoria Street
Berkeley IL 60163

I'm looking for the following NAVSHIPS manuals: 93788 Vol. 2/3, 92175, 93241, 93210, and 91713

Charles T. Huth WB8NLM
229 Melmore Street
Tiffin OH 44883

Need one each 6SK7 and 6SG7 tubes. Will trade other items for same.

Gerald Samkofsky N4ZB
1420 Mount Vernon Drive
Holiday FL 33590

I have an R-508/ARC Command Receiver and badly need a schematic diagram of it. If you could supply one I would be glad to pay for it.

Martin Prescott
69 North Shore Road
Derry NH 03038

Wanted: Operation and/or service manuals for the Cushman CE-2B service monitor. I will pay any reasonable costs involved.

Dave Land **KD5FX**
2515 Bonnie
Ponca City OK 74601

I need any information on a computer unit labelled "C3 Data System" and "Interdata." The processing part has the identification number 7/16Jwin. The frequency meter is by Eldorado Electrodata ACL model FRO-212-2, also known as model number 1660-4, pulse generator Rutherford Elect. Co. model B7F. All items bought at a U.S. Army sale in Europe. All reasonable expenses paid.

Crispino Messina
Via di Porto, 10
50058 Signa Fi, Italy

I am compiling a list of international amateur radio nets (DX or special interest), calling frequencies, gentlemen's agreements, and so on. Details appreciated.

Ash Nallawalla ZL4LM/VK3CIT
PO Box 539
Werribee VIC 3030, Australia

I have inherited a 6-element tribander manufactured by TET. The instruction manual that accompanied the antenna is for model TE-3F36DX. Unfortunately, the dimensions in the documentation do not match the aluminum in my garage. Calls to TET and their distributor have not shed any light *on the situation.*

Does anyone have any data on 6-element TET tribanders?

Bernard M. Spiegel KJ4KR
ex N4MJC
PO Box 161192
Memphis TN 38186

TEST EQUIPMENT

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HP 608D SIGNAL GENERATOR, 10 MHZ TO 420 MHZ AM, CW OR PULSE OUTPUT, 400/1000 HZ MODULATION OMV TO 5V INTO 50 OHMS, CALIBRATED ATTENUATOR $295.00
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HP-618B SIGNAL GENERATOR 3.8 GHZ TO 7.6 GHZ, 0.1 MV TO 1V INTO 50 OHMS, CALIBRATED OUTPUT, INTERNAL, EXTERNAL PULSE OR FM MODULATION $375.00
SG-557/URM-52 SIGNAL GENERATOR 3.8 GHZ TO 7.6 GHZ, MIL/SPEC MILITARY VERSION, SAME AS HP618B $325.00
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HP 626A SIGNAL GENERATOR, 10 GHZ TO 15 GHZ INTERNAL, EXTERNAL, PULSE, SQUARE WAVE, FM MODULATION CALIBRATED OUTPUT, 10 MW TO 1 PW $650.00
HP 628A SIGNAL GENERATOR, 15 GHZ TO 21 GHZ, CALIBRATED OUTPUT 10 MW TO 1 PW INTERNAL, EXTERNAL, SQUAREWAVE, PULSE, FM MODULATION $650.00
URM-25 MILITARY SIGNAL GENERATOR, 10 KHZ TO 50 MHZ, RF OUTPUT 0 MV TO 2 VOLTS AM/CW 400/1000 HZ MODULATION, 50 OHM STOP ATTENUATOR, SMALL PORTABLE UNIT $245.00
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HP 5245L FREQUENCY COUNTER, MEASURES FREQUENCY, PERIOD, RATIO AND MULTIPLE RATIO MULTIPLE PERIOD AVERAGE, FREQ. RANGE 0.TO 50 MHZ WITH HP5253B PLUG-IN SUPPLIED, EXTENDS RANGE TO 500 MHZ, SOLID STATE COUNTER $375.00

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough NH 03458-1194.

WEBSTER MA
APR 27

The Eastern Connecticut Amateur Radio Association will hold the 12th annual ECARA Flea Market on April 27, from 10 a.m. to 2 p.m., at the 200 Sportsmens Club, Sutton Road, Webster MA 01570. Admission is $2; tables are $5 in advance and $7 at the door. Parking is free. For further information, contact Tom Francis KB1SP at (617)-943-7283, Dick Spahl K1SYI at (617)-943-4420, or Don Amirault K1APE at (203)-923-2727.

SIERRA VISTA AZ
MAY 2–4

The Cochise Amateur Radio Association will hold its 1986 hamfest on May 2–4 at the club's training facility on Moson Road (which intersects Route 90 five miles east of the 90/92 junction, in Sierra Vista). All ham-radio, computer, and related businesses are invited to attend. Ham exams on May 4. No charge for tailgaters; primitive overnight accommodations for RVs. Talk-in on 146.52 and 146.16/.76. For more information, contact Don Morgan W7ACI at (602)-458-5293 or write CARA at PO Box 1855, Sierra Vista AZ 85636.

FRESNO CA
MAY 2–4

The Fresno Amateur Radio Club will hold its 44th annual hamfest on May 2–4 at the Airport Holiday Inn. Inside air-conditioned dealer spaces and swap tables. FCC exams will be given; DX, emergency, and other programs; forums and demonstrations. Talk-in on 146.34/.94. For further information, contact Harry H. Billings, PO Box 783, Fresno CA 93712; (209)-268-6314.

OWEGO NY
MAY 3

The Southern Tier Amateur Radio Clubs will hold their 27th annual hamfest on Saturday, May 3, at the Treadway Inn, Owego, N.Y., beginning at 8 a.m. Flea market, vendor displays and sales, tech and nontech talks, and refreshments. A dinner at 6:30 p.m. (advance tickets only for the dinner). Take Route 17 to Exit 65. Talk-in on .22/.82, .16/.76, or 146.52 simplex. For further information, send an SASE to PO Box 7082, Endicott NY 13760.

BEMIDJI MN
MAY 3

The Bemidji ARC will sponsor a hamfest at 9 a.m. at the Bemidji Middle School on Saturday, May 3. Talk-in on 146.73. For further information, write the Bemidji ARC, PO Box 524, Bemidji MN 56601.

BATON ROUGE LA
MAY 3–4

The Baton Rouge ARC will hold its annual hamfest on May 3 and 4 at the Catholic High School on Heartstone Drive. VE Exams Saturday and Sunday at 8:30 a.m. A limited number of walk-ins will be accommodated. Send Form 610 and a check for $4.25 payable to ARRL/VEC to George Perry W5LVX, 17424 Lady Constance, Greenwell Springs LA 70739. Talk-in on 146.79/.19. For further information, send an SASE to Rick Pourciau NV5A, 879 Castle Kirk, Baton Rouge LA 70808, or call Shirl Cook K5OPL at (504)-766-0200.

GREENVILLE SC
MAY 3–4

The Blue Ridge Amateur Radio Society will sponsor the 47th annual Greenville Hamfest and Electronic Flea Market on May 3 and 4, at the American Legion Fairgrounds, one mile north of I-85 on Hwy. 25 N. VEC walk-in exams, dealer displays, indoor/outdoor flea market, packet and AMSAT demonstrations; S.C. SSB net, QCWA, ARRL, SCARDS, ARES; food, beverages, camping facilities available. Hours: 8 a.m. to 5 p.m. Saturday (early setup arrangements with advance registrations), 8 a.m.to 3 p.m. on Sunday. Admission is $3.50 in advance, $5 at the gate. Talk-in on 146.01/.61 (146.22/.82 backup). For advance registration, exam details, and further information, write the Blue Ridge ARS, Inc., PO Box 6751, Greenville SC 29606.

ROCKAWAY ARC
MAY 3–4

The Rockaway ARC will operate special-event station K2UHD from 1500 UTC on May 3 until 2100 UTC on May 4 to commemorate the 300th anniversary of the Founding of the Rockaways. Operation will be in the General (phone and CW) and Novice bands. For a certificate, send an SASE to K2UHD, Rockaway ARC, PO Box 214, Rockaway Park NY 11694.

CARMICHAEL CA
MAY 4

The North Hills ARC has moved HAMSWAP 86 to a new location at American River College, 4700 College Oak Drive, Carmichael, on Sunday, May 4, from 9 a.m. to 3 p.m. Free admission, free parking, advance table sales, food and drink available. Talk-in on K6IS repeaters: 145.19 and 224.78 MHz. For further information, write HAMSWAP 86, c/o NHRC, PO Box 41635, Sacramento CA 95841.

SANDWICH IL
MAY 4

The Kishwakee ARC will sponsor the 31st annual First-Sunday-In-May Hamfest on May 4 at the De Kalb County Fairgrounds, Suydam Road, Sandwich IL (just north of Route 34 between Routes 23 and 47, across from the airport). Admission is $2 in advance, $3 at the gate; inside display tables are $5. Outside areas for tailgating; parking is free. Overnight camping (no hookups); coffee and donuts for early birds, food wagon thereafter. Talk-in on 146.52, 444.45, and 146.13/.73. For tickets and/or further information, write to Box 21, Genoa IL 60135.

BOULDER CO
MAY 4

The Rocky Mountain VHF Society will hold its annual spring Ham Radio & Computer Swapfest on Sunday, May 4, from 9 a.m. to 3 p.m., rain or shine, at the Boulder National Guard Armory, 4750 N. Broadway, Boulder. Admission is $3 per family. Flea market, technical seminars, demonstrations, and free HT testing (spectrum analyzer, signal generator, power meter, frequency counter, and 12-volt power supply available). No extra charge for sellers; some tables available. Snack bar. Talk-in on the RMVHFS repeater, 146.16/.76 MHz. For further information, contact Dave McClune WB0ZID, 5338 Spotted Horse Trail, Boulder CO 80301; (303)-530-1872.

W. SPRINGFIELD MA
MAY 4

The Hampden County Radio Association will hold its annual flea market on Sunday, May 4 (rain or shine), from 9 a.m. to 3 p.m., at the West Springfield Elks Lodge covered pavilion on Morgan Road. Admission is $1; tables $5. There will be a $5 charge for each vehicle display. Food and refreshments available. Directions: Mass. Turnpike to W. Springfield Exit 4, 1/2 mile south on Route 5 to Abdow's Restaurant, turn right on Morgan Road; the Lodge is 3/4 mile on left. For further information, call Steve Nelson WA1EYF at (413)-596-8216.

EAST HARTFORD CT
MAY 4

The Pioneer Valley Radio Association will hold its annual flea market on May 4, at East Hartford High School (Penney High), 869 Forbes Street, from 9 a.m. to 3 p.m. (dealer setup at 8). Exams will be given by the Newington Amateur Radio League VE team; walk-ins accepted. General admission is $2; dealer tables are $8. Free parking. Talk-in on 146.19/.79. For further information or to reserve a table, contact Dave Rose KW1V, 13 Long Crossing Road, East Hamptom CT 06424; (203)-267-8993.

DEERFIELD NH
MAY 10

The Hosstraders will present their Spring Tailgate Swapfest on Saturday, May 10, at the Deerfield, N.H., Fairgrounds, benefitting the Shriners' Burns Hospitals (last year's gift: $11,754.46). Admission is $2 per person; no extra charge for tailgaters or vendors. Friday night camping at nominal fee, but no entry before 4 p.m. on Friday. Talk-in on 146.40/147.00. For a map, send an SASE to Nor-

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ter Building, 735 Lafayette Rd. (State Rte. 42 S.W.), Medina, Ohio. Doors open for setup only at 6 a.m. and will be open for the public from 8 a.m. to 2 p.m. Free parking. Refreshments available. Tickets are $3.50 in advance, $4 at the door; tables are $6, flea-market space is $4. For advance reservations and tickets, write to PO Box 452, Medina OH 44258, or call (216)-725-4492 or (216)-769-3033. Talk-in on 147.63/.03 (K8TV/R).

ARMED FORCES DAY
MAY 17

The 37th annual Armed Forces Day will be recognized by Amateur Radio Station W4ODR, located Northside aboard Naval Air Station Memphis, Millington, Tenn. It will be operated by sailors and Marines from 1400Z to 2200Z on Saturday, May 17, continuously (it is hoped), as follows: SSB—7.230, 14.280, and 21.370 MHz (±10 kHz); CW—21.145 and 28.145 MHz; and 2m on 146.52 simplex. Visitors will be welcome.

Special red, white, and blue certificates will be available to those who work Whiskey Four Old

The Rhode Island FM Repeater Service, Inc., will hold its annual spring flea market and auction on Saturday, May 17, from 9 a.m. to 5 p.m., at the American Legion Fairmount Post 85, 870 River Street, Woonsocket. Admission is free; flea-market spaces are $5 each. The auction begins at noon. Talk-in on .34/.94 and .52. For more information, contact Rick Fairweather K1KYI, Box 591, Harrisville RI 02830; (401)-568-3468 from 7–9 p.m.

CADILLAC MI
MAY 17

The Wexaukee ARA will sponsor its 26th annual Swap Shop at the Wexford Civic Arena, Jct. of N. Mitchell (U.S. 131) and 13th Street, on May 17th, from 8 a.m. to 2:30 p.m. Admission is $2.50; food and refreshments available. Talk-in on WD8RZL (.97/.37). For further information, write to PO Box 163, Cadillac MI 49601.

PITTSBURG KS
MAY 17

The Pittsburg Repeater Organization, Inc., will hold its 1986

Hamfest in the Lincoln Park Pavilion, Pittsburg, on Saturday, May 17, from 10 a.m. to 8 p.m. Free tables; covered dish dinner at 6 p.m., chicken and beverage furnished by the club. Talk-in on .34/.94 or .84/.24. For further information, write Ken Johnston, PO Box 303, Pittsburg KS 66762.

SAC MUSEUM
MAY 17

The Omaha, Nebraska, AKARBEN ARC will operate station /ØEQU from 1400 UTC to 2300 UTC on May 17 from the Strategic Air Command Museum in celebration of Armed Forces Day. Operation will be in the lower 25 kHz of the 10–80-meter General bands. Send a QSL and an SASE to AKSARBEN ARC WØEQU, Box 291 D.T.S., Omaha NE 68101.

BRENHAM TX
MAY 17–18

The Brenham ARC will sponsor the Brenham Springfest on May 17–18 (10 a.m. to 6 p.m. on Saturday; 8 a.m. to 4 p.m. on Sunday) at the Washington County Fairgrounds, Brenham. Admission is free and tables are $5. Talk-in on 147.26/.86. For more information, contact J. McDermott, PO Box 162, Brenham TX 77833; (409)-289-3600 from 7 a.m. to 3 p.m. CST.

ZILWAUKEE BRIDGE
MAY 17–18

The Bay Area ARC and the Saginaw Valley ARA will operate stations K8DAC and N8GKM from 0000 UTC on May 17 through 2400 UTC on May 18 from the Zilwaukee Bridge, the only drawbridge on the U.S. Interstate system, to commemorate Michigan Week. To earn a certificate you must contact both stations. Operation will be about 20 kHz above the General and Novice splits on 20, 40, 80, and 160. Send an SASE with 44 cents postage or an IRC to SVARA/BVARC Special Event, PO Box 1783, Saginaw MI 48605-1783.

HOLY LAND, U.S.A.
MAY 17–18

The Waterbury, Conn., ARC will operate a special-event station from Holy Land, U.S.A.—a miniaturized replica of the Holy Land at the time of Christ, atop Pine Hill, overlooking the city of Waterbury—on May 17 and 18. Callsign will be KA1YP, and the operation will run during daylight hours on 40-, 20-, and 15-meter SSB. QSL (SASE only) to *Callbook* address. Richard A. Jacovino KA1YP, 101 Woodbine Street, Waterbury CT 06705.

VE1 ABEGWEIT AWARD
MAY 18

The Prince Edward Island Amateur Radio Association will sponsor a special event featuring the little-known Abegweit Award on Sunday, May 18, from 1200 to 0000 UTC, SSB and CW only, with bands changing according to band conditions. CW—21.100, 14.050, 7.100, and 3.700; SSB—21.300, 14.250, 7.200, and 3.800.

Abegweit, a Micmac Indian word meaning "Cradled on the Waves," was the earliest name for PEI, which is located in the Gulf of St. Lawrence.

VE1 and VO1 stations must confirm contacts in all three PEI counties (Prince, Queens, and Kings). All other VEs and U.S. amateurs must confirm any three PEI stations. All amateurs other than continental United States and Canada must confirm two PEI contacts. Any such contacts since January 1, 1960, are valid.

Send a copy of the log, certified by two other amateurs, and $2 or 10 IRCs to PO Box 1232, Charlottetown, Prince Edward Island, Canada C1A 7M8. For further information, contact David A. Smith VE1CIK, Box 529, Kensington, Prince Edward Island, Canada C0B 1M0; (902)-836-4246 after 2200 UTC.

WABASH IN
MAY 18

The Wabash County ARC will sponsor The Indiana Hamfest on Sunday, May 18, beginning at 6 a.m. (setup time Saturday afternoon and evening), at the Wabash County 4-H Fairgrounds in Wabash, Ind. Overnight free parking for campers; tables available. Exams for Tech through Extra, 8 a.m. until noon. Admission will be $2.75 in advance, $3.25 at the door. Talk-in on 147.63/.03, 146.52/.52, and 146.94/.94. For more information, contact Donald Spangler W9HNO, 235 Southwood Drive, Wabash IN 46992; (219)-563-5564.

WILLINGBORO NJ
MAY 18

The Willingboro, N.J., Repeater Group will hold its annual Hamfest on Sunday, May 18, from 8 a.m. to 3 p.m. (setup from 6 a.m.) at the Holiday Lakes, Route 130 and Creek Road, Willingboro. Admission $3 (adults) or $2 in advance, $5 for table space/tailgate. Talk-in on 146.925, 224.860, and 146.52. For further information, contact Jack Engel K2KLM, PO Box 31, Rancocas NJ 08073; (609)-877-5249 after 6 p.m.

PARAMUS NJ
MAY 18

The Bergen ARA will hold a Ham Swap 'N' Sell on Sunday, May 18, from 8 a.m. to 4 p.m., at Bergen Community College, 400 Paramus Road, Paramus. Tailgating only; bring your own tables. Amateur license exams. Buyers free; sellers $5. Thousands of spaces. Talk-in on .79/.19 and .52. For further information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450; (201)-445-2855 nights only.

UNION ELECTRIC COMPANY
MAY 18

The Union Electric Ham Radio Club will operate special-event station KA0AWS on May 18 from 1800–2300 UTC to honor the employees of the Union Electric Company (serving parts of Missouri, Illinois, and Iowa). Operation will be 25 kHz up from the lower edges of the General portions of 80, 40, and 20 meters, and also on a 10-meter FM repeater on 29.620/.520 and a 10-meter repeater on 147.06/.66. Send your contact number and a large SASE (39 cents) for an 8-1/2 x 11 certificate to: Henry G. Schaper, Jr. KA0AWS, 241 Tapestry Drive, St. Louis MO 63129.

TAYLOR MO
MAY 18

The Western Illinois ARC will hold its 1986 Tri-State Swapfest (from 9 a.m. to 3 p.m.) in conjunction with the Experimental Aircraft Association's Fly-In Breakfast on Sunday, May 18, at Haerr Field, Taylor, Mo. (five miles west of Quincy, Ill., at the junction of State Routes 61 and 24). VEC exams will be offered for all license classes. Admission tickets $1 each or 6 for $5; tailgate flea-market spaces $2 in advance or $3 at the gate. Talk-in on the 147.03 repeater. For further information, write the Western Illinois ARC, PO Box 3132, Quincy IL 62301.

OMAHA NE
MAY 18

The AK-SAR-BEN ARC will host its annual auction on Sunday, May 18, at the Radial Social Hall, 1516 Northwest Radial Highway, Omaha, at 9:15 a.m. (equipment check-in starts at 8 a.m.). Food and beverages on the premises. No admission charge. Talk-in on 146.34/.94. For further information, call Greg N0BTN at (402)-895-5219.

FREMONT OH
MAY 18

The Sandusky Valley ARC will hold its annual hamfest at the American Legion Home, 2000 Buckland Ave., Fremont, Ohio (southwest edge of Fremont), on May 18, starting at 8 a.m. (open at 6 a.m. for setup). Advance admission $2.50; $3 at the door; 8-foot table space $6; free tailgate/trunk space; free parking. Talk-in on .52 simplex or 146.31/.91. For tickets and further information, send an SASE to Pat. D. Keating WB8KWD, 615 Lime St., Fremont OH 43420.

DALTON MA
MAY 18

The Northern Berkshire ARC will sponsor its annual Spring Flea Market at the Dalton American Legion, Route 9, Dalton, on Sunday, May 18, beginning at sunrise. Admission is $1; XYLs and YLs admitted free; refreshments by NOBARC. For further information, send an SASE to NOBARC, PO Box 591, Williamstown MA 01267.

ATHENS OH
MAY 18

The Athens County Amateur Radio Association will sponsor its 7th annual hamfest on Sunday, May 18, in the City Recreation Center on East State Street, from 8 a.m. to 3 p.m. The focus will be on the use of computer technology in ham radio. Packet-radio demonstration. Outdoor (paved) flea-market space free for tailgating or your own tables; indoor space by reservation only through Sam Stewart KA8NIE, 116 Franklin Avenue, Athens OH 45701; (614) 592-5330. License exams for all levels. Walk-ins accepted. Hamfest admission is $3 in advance and $4 at the gate. Talk-in on 146.34/.94. For further information, write Carl J. Denbow KA8JXG, 63 Morris Avenue, Athens OH 45701.

OLD WESTBURY NY
MAY 18

LIMARC will sponsor an ARRL outdoor hamfest at the N.Y. Institute of Technology, Northern Blvd., Rte. 25A, 1 mile east of Glen Cove Road in Old Westbury (Exit 39N-Rte. 25A), from 9 a.m. to 3 p.m. (7:30 a.m. for sellers). Plenty of parking; catered food. General admission for hams is $3. For further information, write Hank Wener WB2ALW, 53 Sherrard St., East Hills NY 11577, or call the LIMARC Infoline at (516)-796-2366.

CICERO IL
MAY 18

The 900-MHz Users Group will sponsor an all-indoors hamfest on Sunday, May 18, at the Palace Hall, Central & Cermak, in Cicero, Ill., beginning at 7 a.m. Coffee, rolls, and food will be available. Tickets are $3 each; tables supplied at $5 each. Talk-in on 146.52. For further information, write the 900-MHz Users Group, 2247 N. Spaulding, Chicago IL 60647.

PICCOLO SPOLETO FESTIVAL
MAY 24–JUN 7

The Trident ARC will operate N4EE to commemorate the Piccolo Spoleto Festival's ninth season of presenting local and southeastern regional talent from every artistic discipline, as follows: 1400 UTC to 2400 UTC on May 24–25, May 31–June 1, and June 7. SSB—7.249, 14.240, 21.340, and 28.540; CW—7.120 and 21.120. Certificate for QSL and large SASE to TARA, PO Box 73, Summerville SC 29484–0073.

WEST FRIENDSHIP MD
MAY 25

The Maryland FM Association's annual hamfest will be held on Sunday, May 25, from 8 a.m. to 4 p.m., at the Howard County Fairgrounds, West Friendship, (I-70, 30 miles west of Baltimore). Inside tables $7 by reservation, $10 at the door (if available). Donation is $3. Talk-in on 146.16/.76, 222.16/223.76, or 449.1/444.1 MHz. For tables or information, contact Michael Cresap W3IP, 1921 Pometacom Drive, Hanover MD 21076; (301)-551-3567 between 6 and 10 p.m.

HUMBOLDT TN
JUN 1

The Humboldt ARC will sponsor its annual hamfest on Sunday, June 1, at Bailey Park, 22nd Avenue, Humboldt, from 8 a.m. to 4 p.m. Admission is $1; food and refreshments available. Flea market; ladies' activities; parking for RVs. Talk-in on .37/.97. For further information, contact Ed Holmes W4IGW, 501 N. 18th Avenue, Humboldt TN 38343.

MILESTONES OF MEMORIES
JUN 6–8

The Wichita (Kansas) ARC station, W0SOE, will be operating from Lewis, Kan., on June 6, 7, and 8 to help celebrate its centennial. The Milestones of Memories operation will be on approximately 3.875, 7.250, 14.250, and 21.325 MHz. QSL via W0SOE, Wichita ARC, 707 N. Main, Wichita KS 67203.

OHIO WINE MONTH
JUN 7–8

WINO (Wireless Institute of Northern Ohio), an organization sponsored by the Lake County Amateur Radio Association, will be on the air from a winery in Madison, Ohio, with the call KO8O, to commemorate Ohio Wine Month. Operation will be on 3860 and 7235 kHz from 2300 UTC to 0300 UTC, Saturday, June 7, and on 7235 and 14,235 kHz

from 1500 UTC to 1900 UTC on Sunday. For a special 8-1/2 x 11 certificate, send a legal-size SASE to KO8O WINO Weekend, 7126 Andover Drive, Mentor OH 44060.

ST. PAUL MN
JUNE 6–7

The North Area Repeater Association will sponsor its Amateur Fair on the weekend of June 6 and 7 at the Minnesota State Fairgrounds in St. Paul, Minn. Admission is $4 in advance or $5 at the Fair. Amateur license exams will be given. Giant outdoor flea market, exhibits, commercial dealers. Free overnight parking June 6 and 7 for self-contained campers. Talk-in on .25/.85 or .16/.76 repeaters. For dealer inquiries, tickets, and further information, write Amateur Fair, PO Box 857, Hopkins MN 55343, or call (612)-566-4000.

LIGHTSHIP PORTSMOUTH
JUN 6–8

The Portsmouth (Virginia) ARC will operate W4POX on June 6–8, 1500–0800 UTC daily, from the Lightship Portsmouth at the Portsmouth Seawall Festival. Frequencies are 7.230 and 14.290. For a comemorative QSL, send a QSL and an SASE to W4POX, 4800 Manor Avenue, Portsmouth VA 23703. For a QSL and a certificate, send your card and a 9 X 12 envelope with 44 cents postage.

GUELPH ONT
JUN 7

The Kitchener-Waterloo ARC will sponsor the 12th annual Central Ontario Amateur Radio Flea Market and Computerfest on Saturday, June 7, from 8 a.m. to 2 p.m., at the Col. John McRae Legion Hall, Guelph. Admission is $2. Inside space is $8 (table included). Outside space is $3. Talk-in on 147.960/.360 and .52. For more information, write the Kitchener-Waterloo ARC, PO Box 812, Kitchener, Ontario, Canada N2J 4C2, or call Paul VE3CHM at (519)-579-3057.

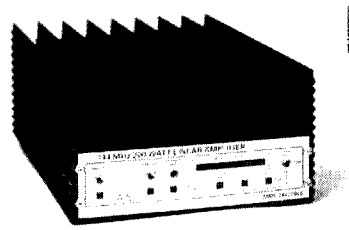
25TH ANNIVERSARY
FAIR LAWN NJ ARC
JUN 7–8

The Fair Lawn ARC will operate the club station under founding-member Frank Leonard's call, W2NPT, to commemorate the 25th Anniversary of the club. Operation will be from 1300 to 2200 UTC on the 7th and from 1400 to 1500 UTC on the 8th. Frequencies: CW—7.050, 7.110, 14.050, and 21.050 (±10 kHz); phone—7.285, 14.285, and 21.385 (±10 kHz). For a certificate, send QSL and SASE to Frank Leonard W2NPT, 17–12 Well Drive, Fair Lawn NJ 07410.

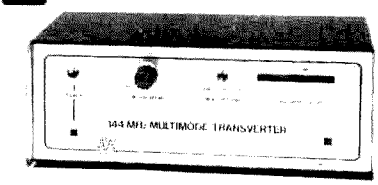
BSA SCOUT-O-RAMA
JUN 14

The Chicago Suburban Radio Association will operate its third annual special-event amateur-radio station, N9BAT, from the Brookfield Zoo, Brookfield, Ill., on June 14, from 1500 to 2300 UTC, as part of the West Suburban Council, BSA, annual Scout-O-Rama. Frequencies: 7.250 and 14.250 MHz. A special full-color QSL card available for a QSL card and business-size (#10) SASE to N9BAT Special Event, PO Box 88, Lyons IL 60534.

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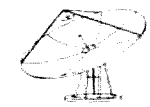
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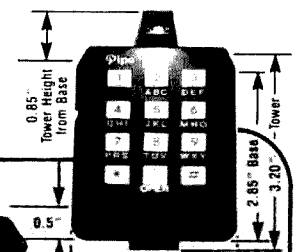
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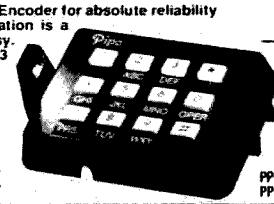
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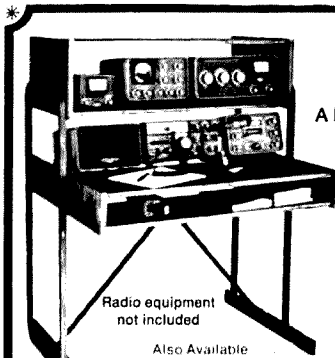


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WANTED: HALLICRAFTERS SX62A. Send price and condition to E. Engelken, 406 Harcourt, San Antonio TX 78223. BNB443

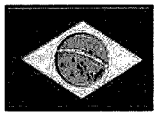
RAYTHEON 4D32 transmitting, $35.00. Inquire on others. Wanted: Morrow receiver MBR560 SSB transmitter Morrow. Levy W5QJT, 101 East Driftwood #26, Fredericksburg TX 78624. BNB444

KENWOOD AND ICOM general-coverage transmit for TS-430S and IC-745 the right way. Send $3.00 to W.E.T., PO Box 96, Uniontown PA 15401. BNB445

73 INTERNATIONAL

Just because I started this column as a result of visiting DX hams is no reason you shouldn't put in your 2¢ worth and let me know what DX news you find most interesting. My inclination is to have DX ops tell us what they think is interesting—how we can get permission to operate if we're fortunate enough to visit—any coming DXpeditions—what's doing with repeaters—things like that. What do YOU find most interesting? Since we have a world hobby, I think you'll be as interested as I in what is going on. If nothing else, it gives us something to talk about on the air which, from what I'm hearing these days, can't hurt.

—Wayne.



BRAZIL

Gerson Rissin PY1APS
PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

BRAZILIAN AMATEURS IN ANTARCTICA

The third Antarctica Mission, sponsored by the Brazilian Navy, had in its crew two amateurs who put on the air for the first time the station ZXØECF, located on the King George Island, South Shetlands. Its geographic coordinates are 62.05 south and 58.23 west. The amateurs were Sinval Viana Silva PY1AFP and Nilson Gomes Silva PY1AFQ. They both used the special call above, issued by the Brazilian Communications Department (DENTEL) only for this event.

The equipment used was a Harris, which worked from 2 to 30 MHz, developing about 125 Watts, and an omnidirectional whip about 35 feet high. They were very active on 14 MHz, more in SSB than in CW because they had hard traffic between the crew (composed of 22 persons) and their families in Brazil. Meanwhile, they were able to work about 1500 different stations.

Last year, ZXØECF went QRT on April 30. The QSL information is PY1AFP or PY1AFQ, PO Box 58, 20001 Rio de Janeiro, RJ, Brazil. In 1986, during the 4th mission, ZXØECF will be on the air again for about five months.

In spite of affirming the Pact of Antarctica in 1975, Brazil started its scientific studies there only in 1982. During the second expedition a few regions were checked to decide where would be the best place to have the base. At first, five points were chosen to be visited: Dorian Bay, Port Lock Roy, Py Point, Andword Bay, and King George Island.

The last was determined to be the best because it has a wide area, a good place to anchor ships, and especially, was near a few foreign bases such as Teniente Rudolph Marsh (Chile), Jubany-Poter Cover (Argentina), Bellinghshausen (Soviet Union), Arctowski (Poland) and Chinese Wall (China), where they could have all kinds of help, considering that Brazil was a newcomer in that region. The assembly of the base lasted twelve days, and about 200 friends from the other bases came for its inauguration: the Brazilian base, the Comandante Ferraz Antarctica Station.

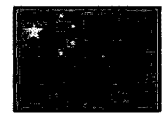
PIONEIROS RADIO CLUBE

Installed February 27, 1982, in the city of Recife, the PRC (Pioneers Radio Club) is a nonprofit organization of professional CW operators, active or retired, who are also ham operators. You may apply for membership by sending a copy of your professional license, your QSL card and 10 IRCs.

The Club was first directed by PY7HQ, PY7FI, PY7PO, (now PR7PO), and PY7FY. Carlos PY7HQ is still president. The PRC recognizes pioneer CW operators who maintained for many years in the past the only reliable kind of transmission. Already 49 Brazilian and 4 foreign amateurs have joined the PRC.

One of the activities of the Club is sponsoring the Worked Maritime Mobile Award (WMM), which is available to all licensed amateurs for confirmed contacts with 5 (five) stations maritime mobile of five different countries. For example: PY1ASI/MM, OH1SY/MM, JF6LZT/MM, DK2MI/MM, and YU3AG/MM.

Contacts must have been made after February 27, 1982, on any amateur band, only two-way CW mode. Minimum report is 338. Send your list of stations worked (call, date, time, band, mode, and report), copies of the five received /MM QSLs, and 10 IRCs for mailing expenses to: PRC, PO Box 1470, 5000 Recife, PE, Brazil.



REPUBLIC OF CHINA

Tim S.H. Chen BV2A/BV2B
PO Box 30-547
Taipei, Taiwan, 107
Republic of China

GOLDWATER VISITS

United States Senator Barry Goldwater K7UGA recently made a trip to Taipei, Republic of China; this long-wished-for expedition was postponed since November, 1984. The mission consisted of seven members, including the Senator himself, David Siddall K3ZJ, Larry Kettlewell W3HHG, Thomas J. Warren K3TX, Roland McElroy K4OCI, Jeff Hutchinson W4PBC and Karl Renz K4YT.

K4YT came from Manila alone and the others arrived in Taipei on January 2, 1986 during the New Year holiday. Three monobander beam antennas for 15, 20, and 40 meters with 2 linear amplifiers, 30L-1 and Dentron MLA 2500, were brought in from Manila and the States. The antennas were transported from the international airport to Taipei and immediately installed at two different locations for the seven-day operation. In addition, four transceivers, TS-930S, FT-901D, TS-430, and IC-741, were borrowed from local hams.

The two locations are separated by about 3 km, one of them the same QTH near the suburb park provided for use by the six DXpedition groups in the past, and the other, a new QTH situated at a high-rise 13-story building downtown. These arrangements were made in honor of Senator Goldwater, who would open the station, and for the convenience of simultaneous operating without causing any interference.

At 5 p.m. on January 5, Mr. Lien Chan, Minister of Communications, personally handed station license BVØBG to Senator Goldwater, wishing him every success for the DXpedition. The Minister said, "This is really a unique activity."

There were about 20 reporters from local TV stations and news agencies crowded in the station. The flashlights and floodlights made the decorated hall even brighter and more colorful for photographing. Our activities caught all eyes with admiration through the three TVs and most important papers on the following day.

Mr. Y.C. Huang (ex-C9YC), Secretary General of the China Radio Association, presented the senator with a hand-painted scroll with a picture of the senator standing beside a gnarled pine tree. The picture depicts the idea of longevity, and the senator accepted it with great pleasure. Six ham members of the mission also received a medal with a certificate of appreciation and a souvenir from the CRA. Meanwhile, Senator



Senator Goldwater received the BVØBG station license from Minister Lien Chan. David Siddall K3ZJ looked on.



At the China Radio Association Banquet, (l to r) Roland McElroy K4OCI, Larry Kettlewell W3HHG, Y. C. Huang, ex-C9YC, David Siddall K3ZJ, Karl Renz K4YT, Garry Denitto of AIT, Thomas Warren K3TW, Jeff Hutchinson W4PBC, Tim Chen BV2A/BV2B, and H.C. Hu, Secretary of CRA.

Goldwater honored the CRA by giving a set of American-published amateur radio literature to BV2A/BV2B (the writer), as chairman of CRA Amateur Radio Commission. It included a copy of the ARRL 1986 *Radio Amateur's Handbook* bearing the Senator's autograph.

Returning to a CQ call, five stations from Marshall Island, Japan, and the Philippines got contact with the senator. It was regretful that he could not hold on longer on the air owing to participating in another party. Then someone else took over the mike and continued the QSOs.

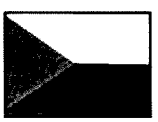
That evening a banquet was hosted by the China Radio Association at the Lai Lai Sheraton Hotel to welcome the DXpedition as well as to commemorate mutual goodwill and friendship. Many officials of the government's Information Office, Ministry of Foreign Affairs, Ministry of Communications, and the American Institute in Taiwan were present. The party ended in joy.

On January 10, the mission was satisfactorily accomplished and all members left for the States. By a rough estimate there were approximately 7000 QSOs with 73 countries contacted on 160, 80, 40, 20, 15, and 10 meters. It is noted that the mission initiated the use of 160 and 80 in this area, but this was a temporary measure, specially approved for the expedition, and can not to be considered as a practice. 80-meter operation created some TVI, which we should try to remedy.

Many new ham calls are active on 7, 14, and 21 MHz. From this area, they are BV2DA, BV2FA, BV5HA, BV6IA, BV7JA, BV7KA, and BV7LA. Moreover, BV2GA, BV7MA, BV5NA, BV2OA and BV8PA are underway to complete their installations within one or two months. Most of these new ones run barefoot at present, although some of them have got 3-element or 5-element beam and linear amplifiers on hand.

Also, be aware of bootleggers —BV9CR, BV0BA, BV0RL and BV0JC are under investigation.

Thousands of DX have been contacted by BV0CRA in the months of November and December, 1985. This special callsign was assigned to commemorate the occasion of the 30th anniversary of the China Radio Association. A demonstration of amateur radio operating took place at its annual convention on November 30, 1985. Two transceivers and two antennas (one 15-meter beam and one tribander vertical) were installed for the operation from morning till night; it attracted 500 visitors. The QSL cards for BV0CRA are ready and being dispatched.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477/8
955 01 Topolcany
Czechoslovakia

QRP IN CZECHOSLOVAKIA

To the list of other OK stations that deal with operation with low power belong also OK1DNM, OK2SAH, and OK3CXS. Milan OK1DNM works with various powers from 50 Watts to 9 Watts. Among his connections there are some partials that have been made with an input between 50 and 100 milliwatts by CW and from 100 milliwatts to 3 Watts operating SSB. With his contacts with VE1 on 14 MHz by 4 Watts and with F on 10 MHz by 50 milliwatts, Milan fulfilled the condition of the diploma 1000 milliwatts.

Alois OK2SAH works on various bands with the longwire antenna by a transceiver of 5 Watts. The transceiver is his own product and it is a faithful copy of the Argonaut of the Ten-Tec firm.

Peter OK3CXS specializes in the 160-meter band where he uses the transceiver M-160 (made in Czechoslovakia) and thanks to the excellent antenna he reaches remarkable results. On the abovementioned band, operating QRP, he has made more than 1000 contacts with 46 states on three continents, according to the DXCC list. To his most interesting contacts belong, for example: EA9, SV5, UA9, UF, UG, UL, UM and 4X4.

With one Watt, he has fulfilled the conditions of the diplomas WAE, W-1000-U, and 100 OK with 1000 milliwatts. He also successfully competes with stations whose capacity is two or three times higher.

On every first Friday of the month, experiments of the OK QRP Circle are held from 1700 UTC on the frequency of 3560 kHz, from 1800 UTC with less than 1 Watt, and from 1900 UTC, with a sufficient number of participants, also on 1875 kHz.

RS SATELLITES

For the converter 21 and 29 MHz, the indication mode K is used. Soviet satellites RS9 and RS10 (except the mode A) are to be equipped with this converter. At least one of the satellites will have an experimental converter mode T with an input channel on the 21-MHz band and with an output on the 145 MHz.

During April 1985, Ondrej OK3AU worked several times with the station from Alaska, KL7JIZ in Fairbanks, through the converter on the satellite RS8. The condition for making contacts for such a great distance lasted approximately 90 seconds.

RTTY

The members of the Radioclub OK1KRY from Rokycany are again very active when operating RTTY. They use the converter ST-5, the teleprinter T-51 and the transceiver "OTAVA" (80–10 meters operation CW/SSB, input of 70 Watts, the product of the firm Radiotechnique in Czechoslovakia). With the help of RTTY they were working with 80 countries according to the DXCC list.

DX

The station EO1AOK was broadcasting from the island Heiss that belongs to the group of islands Franz Jozef Land. If you had been working with it, send QSL via UZ1OWA. In winter 1985/86, UV1OO, UA1OT, and UZ3DD/1 were able to be active from Franz Jozef Land. For all stations, UZ1OWA is manager.



GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Halwey Hill
Camberley GU17 9JO
England

50 MHZ IN THE UK

1986 undoubtedly will be the year of 50 MHz in the United Kingdom. I have already reported the release of the 50-MHz band to UK amateurs following sterling and lengthy efforts by the Radio Society of Great Britain (RSGB). The Society is rightly proud of its efforts in this area on behalf of the UK amateur population, losing no opportunity to let everyone know.

The January 1986 edition of *Radio Communications*, the Society's monthly journal, contained a six-page special on 50 MHz together with a facsimile of the letter received from Barry Maxwell, head of licensing at the UK regulatory authority, the Department of Trade and Industry, Radio Regulatory Division.

The letter sets out the main conditions of the allocation. (In typical British bureaucratic style, the letter emphasis is on all the bad news, particularly the threat of withdrawal if interference is caused to authorized radio services in other countries.) The conditions are:

- usage will be primary (i.e., amateurs have first call on the band)
- only Class A license holders allowed
- maximum power is 20 dBW erp PEP
- maximum transmit antenna height is 20 meters above ground level
- antenna polarization is limited to horizontal
- operation is permitted only

Continued on page 104

73 INTERNATIONAL

from page 100

from the amateur's fixed (home) station

•no repeaters permitted.

The existing special permits for restricted use of 50 MHz by a small number of amateurs are withdrawn. There are no limitations on the mode of operation to be allowed on 50 MHz, so we can expect to see SSTV, RTTY, fax, and data as well as the more traditional modes. With the full availability of 50 MHz from 1st February 1986, it is likely that a number of *73* readers will have added UK contacts to their band totals by the time this is read.

The most significant restrictions seem to be the combination of antenna height and polarization, fixed station operation, and limited power. The regulatory officials are very concerned at the potential for interference with Band 1 television stations in nearby countries. Belgium and Norway particularly are at risk from stations in the south of England and northeast Scotland, respectively.

Clearly the needs of other spectrum users must be properly considered, but I am not sure what answer one would give an Antwerp TV viewer plagued with interference in the middle of a lift...

Just to remind those looking for UK contacts on 50 MHz, there are three 6-meter beacons in the UK: GB3RMK on 50.006, GB3SIX on 50.020, and GB3NHQ on 50.050. GB3SIX has the most power at 100 Watts erp, and is the only beacon to beam west towards the new countries.

You will recall that a full (Class A) license in the UK requires the applicant to pass a Morse test (12 wpm send and receive) in addition to the written examination. To date, Morse tests have been conducted by the Maritime Branch of British Telecom on behalf of the Department of Trade and Industry. Taking a test has been possible at more or less any time (by appointment) but has necessitated a visit to the Maritime Branch's nearest shore station—often a considerable journey.

From April 1, 1986 tests will be available at over 70 testing centers throughout the UK, with every county having at least one location. Tests will be held every two months in each center and at £7, will be less than half the present fee. Once again the improvements are due to the RSGB who have successfully competed with the City & Guilds and British Telecom for the "contract" to operate the service on behalf of the Department.

The RSGB-recorded "newsletter" is updated frequently and provides up-to-the-minute information on happenings in the amateur scene in the UK. The number is 707 52242 (from the US, precede this with 01144).



MEXICO

Mark Toutjian XE1MKT
Apartado Postal 42-048
06470-Mexico D.F.

TRAVELING TO MEXICO?

Traveling to Mexico? You say you would like to get a temporary ham license so you can operate during your stay here? Then I am pleased to provide the following new information.

Since there is no reciprocal agreement between Mexico and the United States and some other countries, obtaining a permanent license may not be possible—unless you want to take the tests involved (in Spanish). However, if you plan to visit Mexico on a temporary basis, how about a temporary license (mobile and/or base station)?

If this is what you want, here are the rules:

1. You must already be a legal ham operator in the country where you reside.

2. Present a photocopy of your valid license.

3. Obtain a letter of recommendation from a Mexican ham. You probably already have made friends with Mexican hams over the air waves. (Note: I cannot give out recommendations because I am not Mexican—although you would never tell by my accent—ha!)

4. Present a photocopy of your tourist card.

5. Indicate in writing an address in Mexico where any correspondence from the Mexican Communications Bureau can be sent to you while you are in Mexico.

6. Indicate in writing where your base station will be located.

7. If you plan to operate mobile, indicate in writing your probable itinerary—locations and dates—during your stay.

8. Be sure to keep an accurate log of *all* your contacts made from within the country, and send a copy of this to the Mexican Communications Bureau as soon as you leave the country.

All of your correspondence can be directed to:

Dirección General de Concesiones y Permisos de Telecomunicaiones
Dirección de Control de Operación de Sistemas Radio Eléctricas
Apartado Postal 55-258
Col. Iztapalapa
09820-Mexico, D.F.
Telephone in Mexico City: 692-0412. Ask for Raymundo Méndez or Jesús Alberto Felix. (A little Spanish will help.) They will be pleased to help you.

If you plan to stay in the border area around Tijuana, you can direct your correspondence to:

Delegación Regional de Concesiones y Permisos de Telecomunicaciones
Lic. Hector Bravos Velarde
Blvd. Adolfo López Mateos 1431
Col. Centro
Mexicali
B.C.N. Mexico

The telephone in Tijuana is 571-208. Ask for Hector Bravos Velarde.

You can ask for a license of the same amount of time authorized on your tourist card. (This can be anywhere from 30 days to six months.) Some who enter Mexico other than as tourists can ask for up to a full year.

It would be good to plan to get your tourist card (or visa) well in advance so that you can include a photocopy of it in your letter with the *other* requirements. Of course, this would be advisable for all of the above points.

Hope this helps answer the many inquiries I have received by mail. I had written to some of you, mentioning that you would have to apply for a permanent license and take the usual tests. However, the above is *new* information that will hopefully be useful for your next trip to Mexico! So, enjoy your vacation and "hasta pronto."



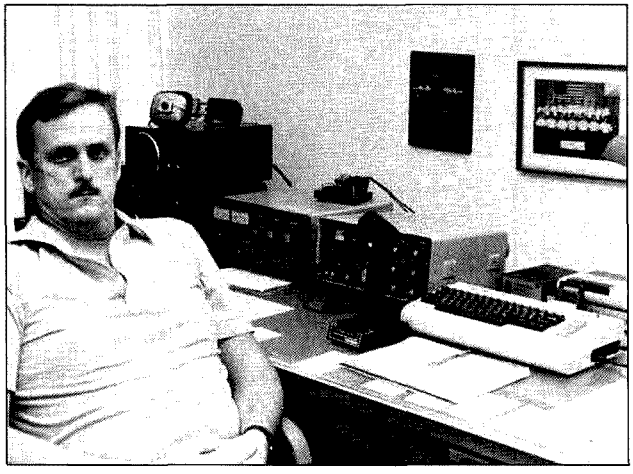
MOZAMBIQUE

Charles E. Martin AB4Y
American Embassy
Department of State
Washington DC 20520

The views and opinions presented are my own and not necessarily those of the State Department or the US Government.

This is my final column from Mozambique. Sadly, I have not been able to secure operating permission. Amateur radio remains "suspended" in the People's Republic of Mozambique, and unless conditions change radically the suspension is not likely to be lifted soon.

The medium- to long-term outlook is, however, promising. Rui Fernandas, the director of CTT (the *parastatal* that administers telecommunications in the Re-



Guam: Our man in Guam: AH2BE (ex KB6DAW/KH2/KH9).

public) is now receiving *QST* and *73* every month. The many positive aspects of amateur radio are now regularly seen by an individual who may be important in returning amateur radio to this country.

Mozambique is a member of SATA (Southern African Telecommunications Administration). SATA is a suborganization of the Southern Africa Development Coordination Conference. The long-term goal of SATA is to expand and link the telecommunications structure of the various member states. A number of telecommunications projects are underway in Mozambique, including expansions of both in-country telephone and telex services and a new satellite communications terminal in the port city of Beira.

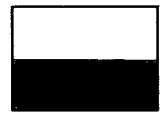
By way of statistics, Mozambique, a country of some 14 million people, has about 52,000 telephones—or one per every 270 people. Most of these telephones are in Maputo. (By comparison, there are more telephones in Tokyo than in all of Africa.) SATA has a formidable task ahead of it. Most of the technicians involved in the upgrade projects are foreigners and are paid in foreign currency, which usually is in short supply in Africa.

All SATA member states except Mozambique permit amateur radio in their respective countries. Perhaps Mozambique will re-authorize amateur radio as a step toward rehabilitating the telecommunications infrastructure and providing a source of trained technicians in the future.

I have been posted to the American Embassy in Paris, France. If you are ever in the neighborhood, just drop by. I will, fortunately, be licensed in France, and I plan to do a great deal of operating. After two long years without amateur radio privileges, it will be great to get back on the air. Perhaps a DX-pedition to C31 or 3A can be arranged.

I am grateful to Perry KW1O and the staff at *73* magazine for the opportunity to write this column. I am sad only about the fact that I could not report any return of amateur radio to Mozambique.

73 and God bless.



POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

POLISH USW CLUB

On June 8th and 9th, 1985, the XXIV Conference of the Polish USW Club took place in Bydgoszcz. The Polish USW movement was represented by 90 participants, among them 50 full members of the club. The Conference elected a new board, with SP9EHS as the president, SP2DDV as secretary, SP9GMT as technical manager, SP6GWN the treasurer and SP6AZT the member at large.

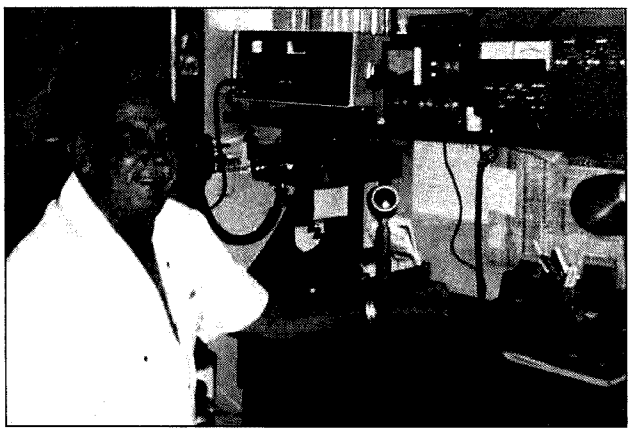
During an hour-long discussion, 19 motions had been brought forward but only 16 of them were adopted. Regarding a contest organized by Eastern Bloc countries, under the name "Victory 41," the Conference adopted a resolution in favor of filling "silent squares QTH" which may appear during the contest.

For many years the USW Club has applied for the right to elect a USW manager at headquarters of PRAA. In a vote adopted by the Conference, the USW Club said it should be able to name know-how USW and microwave managers at the PRAA headquarters. The USW Club should promote the candidates to the National Congress of PRAA with suitable justifications.

Other very important matters, relative to licenses for "portable" and "mobile" modes of work, and use of home and summer QTHs on the basis of permanent permission, were adopted by a solid vote. These new possibilities would contribute to the growth of the SW movement in Poland.

A subsequent vote insists amateurs should be granted microwave bands, using modern kinds of modulations, and transmitting computer data. The XXIV Conference of the USW Club firmly asked for a mail-order technical information center at PRAA headquarters, conforming to a resolution of the general assembly of PRAA in Chorzów.

A few technical lectures were given at the Conference. A lot of interest arose about antenna problems, especially after a SP6LB lecture on antennas with vertical polarization. The president of PRAA, SP5JR, presented his research on the subject of shortwave and microwave propagation and the ground effect of their propagation.



The "grumpy old bloke from Down Under," VK3YJ.



Australia: Preparing the ground for the "new" radio room. The old one (a caboose) is in the background. (See April, 1986 column.)



Jack VK5EJ, the ex-, and Carol VK5PWA, the current president of LEPARC.

LETTERS

from page 12

and nail to keep the ham bands totally amateur. . . .

Jim Wooddell WA6OFT
Parker AZ

Tooth and nail enough to get the FCC to say "no." Good work, guys.—Ed.

OPEN LETTER

Richard Baldwin W1RU
President, IARU

Dear Dick,

The December, 1985, issue of *QST* features a fine article, "Cruising and Amateur Radio," in your IARU news column. In addition to the pirate and unlicensed operation that was mentioned, there are several other unsavory aspects of "cruising" that should be brought to light. What we have is the erroneous belief it is not necessary to obtain "express permission" to operate amateur gear sailing or anchored in another nation's waters. The fact that our licensees aboard sailboats are most vociferous in pushing this concept rather than being passive participants is cause for alarm. After communicating with hundreds of "cruisers," I quickly learned that most of them were mainly drawn toward to the amateur spectrum because it produces a toll-free telephone communication from their yacht to any place in the world. The fact that most of this toll avoidance takes place from foreign jurisdictions certainly represents a clear and present danger to our amateur radio treaties.

If you care to observe the daily spectrum violations, please monitor 14.313 MHz or any of the many "Mickey Mouse" nets that you listed in your column. With the exception of a few Merchant Marine and military vessels, not many of the "cruisers" ever get on the air while actually out on the high seas or in true "international waters." Seldom do "cruisers" ever sail out of sight of land but rather bump along coastlines or from island to island. While sailing, use of amateur equipment is rare because there is just too much activity topside to permit ham-radio use. Most of the phone patching by "cruisers" is evident while they luxuriate in a foreign marina close to all the entertainment.

There is an urgent need for pro-amateur groups worldwide to launch a positive program of education and encouragement of legal use of amateur radio aboard sailboats. The "net junkies" and "network commanders" should receive the hard cold facts of law when they contribute to the numerous daily sovereignty violations by aiding and abetting the cruising violators with such patronizing statememnts as: "they must be underway" or "they are Mickey Mouse off Baja." The fact of the matter is that when a vessel enters a country it remains under that country's jurisdiction until the vessel is legally cleared out. Except for a few cruise ships subject to reciprocal treaty, each boat must be cleared out to a foreign destination. Many "cruisers" foster the ruse that they are "Mickey Mouse" in the Bahamas in order to allow for phone patching while they are actually domiciled on their vessels as visitors of that country. They would now have us believe that even though the boat is in Bahamian waters and their visa is in effect, that by some magic the amateur station can be instantly transported into international limbo-land by saying "we are now underway." The bottom line is that leaving a country's jurisdiction, if done legally, involves more than a mental whim. Please do what you can to place this matter before the IARU and ARRL for a consensus and appropriate action.

73.

Herbert Schoenbohm KV4FZ
Christiansted USVI

MEDIEVAL MEASURING

The comments I am about to make are inspired by articles in your magazine and, indeed, other ham-radio publications in the United States.

I am referring to the continued use of the "medieval" imperial system of measurement in construction features, antenna designs, etc. There can be no excuse for continuing this hodgepodge of measurements in electronics of all things, a science where all the units of inductance, frequency, etc., are SI ones (SI=International Standard).

Where, for example, is the logic in measuring a half-wave dipole for 40 meters in feet?

Also, amateur radio is supposed to foster communication amongst people. According to an article in the *Wall Street Journal*, there are only three countries left in the world still not officially metricated. Guess who? Burma, Brunei, and the United States.

Be progressive—educate your domestic readers. There is no way of pleasing the "imperial lobby" by the consistent use of imperial measures, even if this was considered desirable, since such measures do not exist for most electronic parameters (thank goodness). There is a way of pleasing the rest of us, with the consistent use of SI units.

Perhaps the American amateurs in their journals would care to take the initiative? Let the only feet we read about in ham-radio magazines be attached to cabinets or propping up the editor, and the only pounds be those charged when shopping in the U.K.

Ragnar Otterstad
LA5HE/OZ8RO
Holte, Denmark

MIRAGE IS REAL

How often have you purchased an item which later developed a problem and getting it fixed was an even bigger problem? Well, rejoice! There is a manufacturer who stands behind its equipment.

I was pleased with my Mirage amplifier's performance. One day, after a long-winded QSO, the power amp on a B3016 2m amp quit in a puff of smoke. The amp is used at home with a blower to keep it cool which, considering its good heat sink, is unnecessary but helpful for long key-down times.

I sent the unit, which was a couple of years old, in for repairs. Needless to say, I was surprised to have it returned promptly and with NO CHARGE marked on the invoice. I had expected a long exchange of purchase receipts, letters, charge-card info, and the like. What a nice surprise to have a warranty repair done quickly and without a quibble. I use three of their amps, two at home and one mobile, and have found them to be well made and long lasting even in the 100% duty cycle of ATV operation. I would recommend Mirage to anyone who wants a quality product.

Henry B. Ruh KB9FO
Chicago IL

ISHMOD OUTRAGE

My subscription to *73* just expired and I'm glad. I feel that I have wasted money on the last 18+ months of my multi-year subscription. I used to look forward to receiving *73* every month, but not anymore.

Almost two years ago, in the April issue, an unfinished article appeared in *73*, entitled "Ishmod's Journey," or something like that ["Ishmod's Journal," April, 1984]. It was continued to a nonexisting page. You pulled the same stunt in last April's issue (which I received a few weeks prior to April Fools' Day). There have been mentions of Ishmod in your publisher's column, praising the author. And there have been letters from readers regarding "Ishmod" with the response continued to another nonexisting page. This type of reading is not what I expected from *73* when I subscribed many years ago. I realize that change is necessary, but in my opinion, *73* has changed for the worse. These "Ishmod" articles, in my opinion, were designed as a gimmick to get readers to scrutinize every page of your magazine looking for the conclusion to the article and also provide your advertisers with more exposure than usual.

I do not get the insight into ham radio that I used to from *73*. There are fewer and fewer articles of interest to me and it seems like fewer articles in general. I do not want to go into more detail as I feel that I already wasted too much time and money on *73*.

Alan H. Carp K1HLZ
Natick MA

These "Ishmod" articles, in our opinion, were designed to give 73's readers something to chuckle over. Maybe you've forgotten, but ham radio is supposed to be fun. *And if you'd bother to compare 73 with the other ham rags, you'd notice that, month after month, 73 publishes more articles. Period.—KW1O.*

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PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20					15					
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G=Good, F=Fair, P=Poor.

Look for some disturbances in magnetic field between 5th and 10th with possible storm levels; also possible 6- and 2-meter openings in this period. Again, between the 27th and 30th look for active magnetic field conditions and generally poor propagation on HF, LF, and VHF.

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G	5 G	6 F-P	7 P-F	8 G	9 G-F	10 F
11 G	12 G	13 G	14 G	15 G	16 G	17 G
18 G	19 G	20 F-P	21 P	22 P	23 P-F	24 F-G
25 G	26 G	27 G	28 F	29 F-P	30 P	31 F

WIN A KENWOOD TM-2570A! (see page 97)

73® Amateur Radio

Issue #309
June 1986
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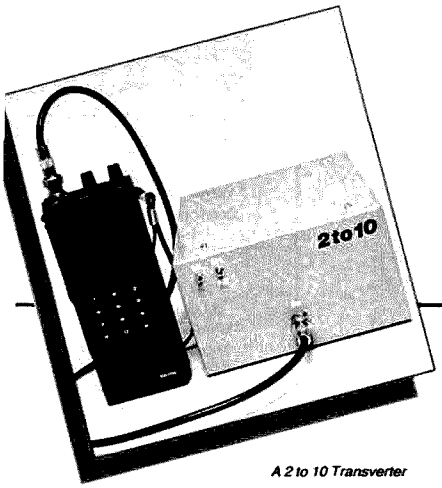
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A 2 to 10 Transverter

73 Amateur Radio

ISSUE #309 JUNE 1986

A WALK THROUGH THE VHF/UHF SPECTRUM 28
This is for all of you who've spent the last forty years on 75-meter AM. KT2B takes us on a guided tour through the five most popular bands above 50 MHz, explaining who's there and just what they're doing.

NASA INTERVIEWS 34
73 asked hams-in-space Owen Garriott W5LFL and Tony England WØORE what they've been up to since their historic flights. You'll be surprised by their answers!

TWO TO TEN 38
Have you tried ten-meter FM? Repeaters are popping up all over the country, and the range is sometimes startling. WB5IPM's little gadget lets you use your two-meter gear to check out the action.

SOME GUYS MAKE IT... 46
OK, we cheated. Those of you who have been reading *73* for the past twenty years have seen this one before. You'll laugh just as hard this time as you did before.

DIGITAL SIMPLEX REPEATERS 48
This combination of packet radio and FM voice repeaters might be a way to ease the overcrowding on our VHF allocation. The system's creator looks at the how and why of store-and-forward voice repeaters.

MESSING WITH MICROWAVES 52
You won't believe how simple it is to play with frequencies in the GHz range. You won't spend a fortune, either, so you can build up two of these stations and have someone to talk with.

THEY THREW WHAT AWAY? 58
Yes, Uncle Sam is up to it again...for the price of scrap aluminum you can get dandy UHF swr bridge. Never mind that you've already paid for it...

THOSE TANTALIZING TWOS 88
Sorry about that title. Get out your tweezers and screw up your courage! Now pop the cover off of your beloved IC-2 or IC-02. A snip here, a tuck there, and *voila* you're holding a 140—162-MHz scanner.

REVIEWS 28, 24
Two reviews for you this month. Above and Beyond columnist Pete Putman KT2B pits ICOM's IC-471A and Kenwood's TS-811A against each other in a head to head battle of the UHF multi-modes. And Marc Stern N1BLH presents the first look at MFJ's hot new packet TNC, the MFJ-1270. Is it the TNC for the masses?


Astronaut Owen Garriott W5LFL

NEVER SAY DIE 4
Really must reading for June. Contains the "missing editorial" absent from the May issue. (OK, since you asked, due to an "editorial oversight" we, ah, forgot to run part of Wayne's column. Just a little part. It's the first time in NSD—*don't miss it!*

DEPARTMENTS

LOOKING WEST & QRP 84, 88
These columns bring back an old friend and introduce a new one. QRP and antenna enthusiast Bill Stocking WØVM opens shop with a monthly feature, mercifully *not* called "Stocking's Stuffers". And we welcome back Bill Pasternak WA6ITF to his old spot in Looking West. Bill has been with *73* since the beginning, and always manages to find something unusual happening on the West Coast. Sometimes he tells us about it.

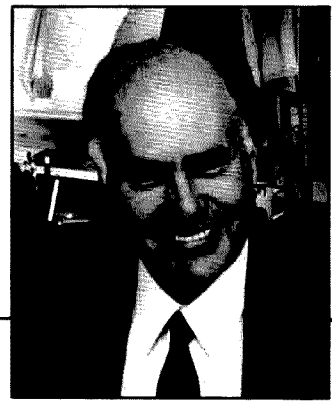
FUN! 83
KI2U has done it again. The annual Fun! poll, that is. This is the pulse of amateur radio, the heartbeat of hamdom, the...well, youget the idea. This year the poll turned out some unexpected results.

RTTY LOOP 74
Must reading for June. Marc Leavey has come up with an incredible poem about finding a program for the Macintosh. Suitable for framing.

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NEVER SAY DIE



COME FLY WITH ME

Are you game to sit down at a rig in a rare DX spot and face the pileups?

A few years ago I started going to Asia every October to see what was new at their yearly consumer electronic shows. It was so much fun that I wrote about it in *73*, urging readers to join me. This resulted in more and more hams going on the tour each year—many repeaters, like me.

On the 1985 trip several of us got to talking about how much fun the trip was, and that got us thinking in terms of organizing a ham expedition for 1986—one which would take us to Korea, Taiwan, and Hong Kong. We thought about including Japan, but with the present cost of the yen—the difficulty of getting a ham license—better off without it.

We should be able to get a license for everyone to operate in Korea, Taiwan, and Hong Kong, so it would be a real ham trip. Also, I think we'll be able to get the local hams to host us, allowing our group to see how it feels to sit and work DX from Asia.

Bob Norman K4GRD was particularly enthusiastic about this idea—excited enough to agree to do most of the work (heh, heh). The tour part will be organized by Bob Chang, who's been running the consumer electronic and computer show tours to Asia for about eight years now. Chang does a fabulous job—which is why there are so many of us who have been making the trip year after year.

If there are enough readers interested in the DXpedition, Bob will organize a hamfest in each city for you to meet the local hams—and perhaps get invited to their homes and operate their station.

I ran a ham tour in 1963 that was a corker. 73 of us—hams and wives—went to London, Paris, Geneva, Rome, and Berlin. I still run into hams at hamfests who tell me that was the best trip they've ever taken. We had a banquet/hamfest with the hams in every city but Rome. We got to visit ham homes and operate.

In Rome we had an audience with the Pope and went on a tour of Vatican radio. In Geneva we got to operate 4U1ITU and in London many of us operated GV2SM at the Science Museum, then the only station in England permitted to handle third-party traffic.

For younger hams—and old ones with short memories—it was while we were working on this tour that the ARRL filed its Incentive Licensing proposal with the FCC—the docket which almost instantly stopped the growth of amateur radio—put 85% of the ham dealers and almost 100% of the manufacturers out of business. With amateur radio self-destructing, that put an end to ham tours.

By the time amateur radio had recovered enough so that a tour might be practical again, I was up to here in computers and starting new computer magazines. I'm not sure that even now we have enough hams with the spirit it takes to go on a DXpedition to Asia.

The tour part is fun in itself. We'll be able to get to the consumer electronic shows in Seoul and Taipei. I enjoy these because I often find products worthy of being imported by my Wayne Green International division—you may have seen ads for Pico Products. It only takes one hot mail-order product to make millions, you know—lots of people have done it.



"While we were diggin' you a deeper ground, we struck oil!"

Continued on page 10

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Novice Phone

THE FCC has proposed an enhancement to the present Novice-class license. The Notice of Proposed Rule Making, **PR Docket 86-161**, calls for data privileges from 28.1 to 28.3 MHz, SSB from 28.3 to 28.5 MHz, all amateur privileges from 220 to 225 MHz, and simplex and repeater privileges from 1246 to 1260 MHz. Power restrictions would be 200-Watt PEP on ten meters, 25 Watts on 1-1/4 meters, and 5 Watts on 23 centimeters. Higher-class stations would be allowed to run the full legal limit in the Novice portions of these bands. Further, Novice licensees would not be allowed to be trustees of a repeater station, although they would be allowed to operate through a repeater. Technicians, because of the structure of the license system, would gain the additional privileges of the Novice enhancement. The FCC is very interested in hearing ideas on several points. Should the Novice-license term be reduced to two or five years to encourage upgrading? Should questions be added to the Novice test to cover the new privileges? Should more than one person administer the test, or should Novices be tested through the volunteer-examination program? Should Element 3 (the General-class exam) be broken into two parts—part A to cover VHF and repeaters and part B to cover HF operation—to make it easier to upgrade from Novice to Technician? Comments on the proposal are due at the commission by July 16th, and reply comments must arrive by August 20th. Send your original comment plus five copies (11 copies if you want each commissioner to have one) to the FCC, 1919 M Street NW, Washington DC 20554. Please include the Docket number in the head of your document.

Albania Mania

GUS BROWNING W4BPD, writing in his *DX'ers Magazine*, reports that OK2RZ and five other Czechoslovakian amateurs have obtained permission to operate from Albania. The DXpedition to ZA is expected to begin around the 20th of September—watch QRX for details. Gus also mentions expeditions to Vietnam and Yemen . . . it looks as though DX is beginning to pick up a bit. The *DX'ers Magazine* is a great source for up-to-minute news; you can write to Gus at PO Drawer DX, Cordova SC 29039. (Tell him you think *73* deserves a kickback for plugging his rag.)

Techno-Tantrums

WHO WOULDA THOUGHT that our announcement of the first 900-MHz amateur communication (QRX, January, 1986) would trigger a range war? **Chuck Gollnick KA7QEN/0** of the **Iowa State University Cyclone Amateur Radio Club** contends that they, not **Mike Krzystniak K9MK/5**, are the rightful holders of the title. Now, this would not be so bad so long as one or the other could produce documentation of the exact time of the contact. Chuck and the boys at Iowa State drew first blood by describing their system: "Our first transmission was keyed by time signals received from WWV. Considering the propagation delay between WWV and Ames (Iowa), the delay in our decoder circuit, and the key time of our transmitter, the signal was transmitted no more than 50 milliseconds after the legal band opening, and probably less than that." To which Mike countered, "I have no doubt that we [members of the Motorola Radio Club in Ft. Worth] beat your alleged 50-milliseconds-after-the-band-opened claim by at least 49.999999 milliseconds. I cannot disclose the commercial techniques that we used to do this with as they are . . . currently proprietary." In the second round, Chuck and the Cyclones pointed out that, "Our first transmissions . . . were made *after* the band was legally open. If . . . your clock was not calibrated to the NBS standard and was, say, just 5 nanoseconds fast, . . . then your first transmissions would have occurred at least 4 nanoseconds *before* the 900-MHz band was open for legal use by amateurs, which would qualify you as the first amateur to earn a pink slip on 900 MHz." In the interest of fair play, and in the spirit of ham fellowship, I think we should point out that Iowa State's transmission was the first *AM* transmission, and the Motorola club's was the first *FM* transmission. Give or take a nanosecond.

OSCAR's Out

AMSAT-OSCAR 10 will not be available for this year's ARRL Field Day exercise, according to the *Amateur Satellite Report*. AO-10 Command Station ZL1AOX indicates that the bird will be visible only during perigee and that it probably will not be turned on due to eclipses during that period. Meanwhile, work is progressing on the next Phase III satellite, which is scheduled for launch aboard an Ariane booster later this year.

Turkey and Ham

AMATEUR RADIO ACTIVITY in Turkey is still increasing, with more than 20 stations now licensed. **Salim Unuver TA1B** details some of the action: "Lots of [Turkish hams] are usually on 14-MHz SSB or CW. Every night, U.S. hams can find TA stations on 14.200 MHz at 1900 UTC. You will hear perhaps TA1C or TA1E, because they are using 3-element beams and running the legal limit of 400 Watts PEP. Other TAs are running 200 Watts to a dipole or ground plane, like me and TA1F, and we are running RTTY on 14.180 each night at 1900, and all day on Saturday and Sunday." Salim points out that TA1 stations are located on the European side of Turkey, while TA2–9 indicates stations on the Asian side. TA0 calls are assigned to stations on Turkish islands.



Salim Unuver TA1B at his station in Ankara.

New SIN

IF YOU PARTICIPATED in the National Six-Meter Invitational Net Activity Day Contest [whew!] on May 31st–June 1st, please mail your logs to Lisa Lowell KA0NNO's new address: PO Box 547, Hugo CO 80821.

Malibu Good Guy

DANIEL GOODKIN KA6VVS, Novice at age 7 and General at age 11, has become the youngest member of the Los Angeles County Disaster Communications Service (a part of the Radio Amateur Civil Emergency Service). Daniel has already earned two commendations from the Malibu Sheriffs Department for his work during the recent Lake Sherwood and Carbon Canyon fires, where he worked for several days carrying messages between key command centers. Belonging to the DCS is a family affair for the Goodkins; Daniel's father Norm is the District Communications Officer for the organization, and Daniel's mother Naomi WB6OHW, brother Brian N6FKG, and sister Mari KA6PTV are all members.

Eagle Droppings

HAVE YOU SEEN the latest catalog from Innovations? They're one of those companies that offer high-tech goodies like wine computers and 127-function watches. On page 38 of the catalog, right between Wet Tunes the Shower Radio and the Bionic Ear, is a little item called the Eagle 1 Professional Transceiver. "Not a toy or Citizens Band walkie-talkie. FCC approved, license information included. The Eagle 1 packs 200 milliwatts of output power for clear, sharp transmissions up to 4 miles. Useful in warehouses, farms, and factories. Choice of 3 crystal-controlled channels within 10-MHz band for privacy (one crystal supplied with each unit)."

Brent Cordes AE6R checked with Samhill Corp., the manufacturer, and discovered that the crystal supplied with each unit is for 446.000 MHz, the national calling frequency for the amateur 440-MHz band! The other two channels are 446.200 and 445.800. I telephoned Samhill in New York and asked what sort of license was required to operate the Eagle 1. "Oh, amateur," was the reply. I can see it now. . . thousands of yuppies buying chic little HTs, only to find a note in the box telling them that they can't use the radio until they learn Morse code and get an amateur license! We've dropped Innovations a polite note, and will let you know what happens.

Pubs Merge

BOB GROVE, Editor of *Monitoring Times*, and Larry Miller, Editor of *International Radio* (formerly *Shortwave Guide*), have announced plans to merge their publications. Starting with the July, 1986, issue, the new *Monitoring Times* will feature an expanded 60-page format and improved laser printing. A one-year subscription is $14, available from 140 Dog Branch Road, PO Box 98, Brasstown NC 28902; (704)-837-9200.

Expo '86

THIRTEEN MILLION VISITORS to Canada's World's Fair of Transportation and Communication will be exposed to the amateur radio virus, thanks to the members of the VE7EXPO Amateur Radio Society. The all-volunteer effort will feature SSB, CW, RTTY, AMTOR, packet, FM, ATV, and SSTV at five operating positions—two for HF and one each for packet, OSCAR, and VHF/UHF. The Exposition, which will run through October 13th, is housed on the Canada Pavilion, "anchored" in Vancouver harbor. The ham station, using special call VE7EXPO, will operate from 10 a.m. to 10 p.m. each day. Local repeaters (146.94, 224.30, and 443.525 MHz) will be monitored to provide directions and assistance to visiting amateurs. If you would like to work from the station, or if your club would like to come up as a group, contact the VE7EXPO Amateur Radio Society at 202-13640 67 Avenue, Surrey, British Columbia Canada V3W 6X5.

Glowing Report

73 INTERNATIONAL correspondent Rudolf Karaba OK3KFO sent us the results of a UHF aurora marathon recently completed in the Soviet Union. For two years, Soviet experimenters have participated in a competition designed to examine UHF aurora propagation. The top three single-op stations are UA3BMJ with 155 QSOs and 5,442 points, UR2RQ with 139/3,795, and UA9XQ with 149/3,159. The top club station is UZ9CXM with 23 QSOs, and the top SWL is UA3-142-198 with 9 reports.

No Note Needed

THE FCC, in a letter to the PHD Amateur Radio Club of Missouri, said that no doctor's statement is required when special amateur testing procedures are needed due to an applicant's physical disability. The statement was necessary under the old testing system when an applicant was unable to travel to an FCC testing site, but the requirement was not carried over to the new volunteer testing program.

4X4 Foray

A TWO-WEEK TRIP to the Holy Lands is being arranged by the Chaverim, an international group dedicated to fostering goodwill among Jewish hams and their friends. The tour will depart from J.F.K. International Airport on Monday, October 27th, and will return to the States on Monday, November 10th. The group will visit Muslim, Jewish, and Christian shrines and will have the opportunity to operate from 4X4 during its stay. There also will be meetings with the Israeli Amateur Radio Club and the Quarter Century Wireless Association. Space is limited, so contact Bill Soble W3QXT, 9357 Hoff Street, Philadelphia PA 19115; (215)-676-6769.

Motorola Morgue

HERE'S A GREAT OPPORTUNITY to get rid of all that junk in your shack (sorry, I meant "valuable communication equipment"). Don Parker, Motorola's Branch Manager for Alaska, is the curator of the new Museum of Early Two-Way Radio Equipment in Anchorage. Don has already gathered a number of vintage VHF/UHF radios, but is looking for more. If you think you might have something that belongs in a museum, get in touch with Don at Motorola, Inc., 5333 Fairbanks Street, Suite lbsgn1, Anchorage AK 99502, or call (907)-562-2111.

Write-In Vote

THIS MONTH YOU'LL FIND a special Feedback card next to page 80. Use it to rate the articles and columns in this month's *73*. When all of the votes are in, we'll award a free one-year subscription (or extension) to the person whose name is on the card we draw out of a hat. While you're filling things out, take a second to complete the Product Report Card, too. In July we will begin publishing a running tally of your favorite radios. . . or least-favorite, for that matter.

Log Jam

LOGS FROM THE DP0SL Hams-In-Space mission of last year have been released. An automatic logging machine aboard the shuttle captured the following U.S. callsigns: AA6G, AJ5L, K1PXE, K6CO, K6NLP, K6RTC, K7PYK, KA0NVT, KA0DO, KA1DUX, KA2RBX, KA6CR, KA7SJP, KB4CRT, KB6FFJ, KB7RV, KC7EM, KD5RO, KD6PY, KD6WG, KD7AW, KG6GF, KG6KO, KG6LC, N1DBB, N2BKT, N3FL, N6CAV, N6FF, N6GVP, N6IDN, N6RW, N7GDW, N7ZL, N9AB, NA6E, ND2X/5, NF6S, NK6K, NN0V, W0BPP, W1HH, W1NU, W2JNO, W3IP, W3PM, W4BE, W4MOP, W5AQQ, W5CBT, W5EBH, W5HQQ, W5HUQ, W5RRR, W5VY, W5ZIB, W6KH, W6MFO, W7MCU, W7OHF, W7QLC, W7US, W9ODI, WA0RCX, WA1FCK, WA1OMM, WA3HUP, WA3WBU, WA4BUS, WA5NOM, WA5RCL, WA5ZIB, WA6YBT, WA7GCS, WB4KXB, WB5BSH, WB5GLD, WB7AYU, WB5LBJ/DU6, WB7OHF, WB8OTH, WD4AHZ, WD4BCS, WD4NAE, WD4PQN, WD5EZR, and WD9IIC.

QSL

That's all for this month. Thanks to *Westlink*, the *W5YI Report*, *Amateur Satellite Report*, Tad Cook KT7H, Robert Smits VE7EMD, and the *DX'ers Magazine* for help with this month's column. Send your news and photos to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: QRX.



Canada Place, site of the Canada Pavilion and special-event station VE7EXPO.

NEVER SAY DIE

from page 4

We stay in the best hotels and get great breakfasts every morning as part of the tour package. The tour includes air fares, land transportation, airport taxes, and so on. The ham DXpedition will include at least one hamfest dinner in each city. Chang also organizes reasonably priced dinner parties for those interested in trying local foods—such as the delicious Mongolian Barbeque in Taipei. Or perhaps, by the time you get to incredible Hong Kong, you'll be ready for a Mexican dinner. That was my choice last October—dragging along a young ham, Chris Peterson KB9YT, and Rod McKuen (the poet), going to the restaurant via the Start Ferry, then a ride on a 75-year-old trolley car. You won't forget a trip around Hong Kong like that—especially at night. We went back to our hotel on the new ultramodern subway.

They've got a 2m repeater in Hong Kong, so we'll all be able to keep in touch from anywhere in the colony. Bob and I were talking about bringing a portable repeater to Taipei, but we don't know whether Tim Chen BV1A will be able to get it okayed or not. It'd be fun, if we could swing it. We might be able to do that in Seoul, too. I got a license there a few years ago as HL9WG and worked all over the city with my HT via a repeater run by Army MARS. Everyone should bring an HT, naturally.

The DXpedition will take about ten days, which almost everyone should be able to finagle.

I should be satisfied with a DXpedition to Korea, Taiwan, and Hong Kong, but I wondered if, as long as we're in the area anyway, you might not want to take just a few more days and make it not just a trip you'll never forget, but one your friends will never forget either. My sneaky plan is to take those with the time and guts on from Hong Kong to Sabah 9M6, Brunei V85, and Sarawak 9M8.

I made this trip three years ago and it was one of the most interesting I've ever made. Along the Borneo north coast is Kota Kinabalu, Sabah, where we'll stay at the Kinabalu Hyatt. KK, as they call it, is a lovely, fascinating town. The hams are incredibly friendly. Until you've gotten on the air from Sabah, you don't know what a pileup really is from the DX end.

The next stop is Bandar-Seri-Begawan, the capital of Brunei—the wealthiest country per capita in the world. We'll stay at the Brunei Sheraton. The hams there are also ultra-friendly. This is the country where people are able to get interest-free loans from the government for cars and houses. The Sultan is the richest man in the world. I wonder if he'll shake hands with us—he might if we have a good-sized group.

In Kuching, the capital of Sarawak, we'll be staying at the new Hilton. On my last trip I got on the air and had a ball. I also made a side trip up into the hills to visit a long-house—a whole village built on stilts, including the sidewalks. There were still skulls hanging from the days, just a generation ago, when these people were still head hunters.

The whole trip—Seoul, Taipei, Hong Kong, Kota Kinabalu, Bandar-Seri-Begawan, Kuching—will take twenty days—about three weeks for an experience you'll never forget. If you go for it, Bob and I have an eye on getting you to China and Macao next year—and probably to Singapore and Bangkok in 1988—unless you'd like to get up to see Father Moran in Nepal and see what it's like to operate from 9N1MM. Yep, I've done that, too. I've operated from all those places. . . ho hum. . . yawn.

Of course it's always possible that amateur radio has been so decimated by its lack of growth for the last 23 years that there aren't enough adventurous spirits left to make a DXpedition like this feasible.

Take a look at your calendar and see if you can get away from October 5th to 16th for the three-country DXpedition—or until October 25th for the six-country DXpedition. The costs aren't firm yet, but should run around $3,000 for the three countries and $5,000 for the six countries.

If you've got enough left to bring your wife, I guarantee she'll enjoy it. There are plenty of things to see and a lot of shopping to do. You probably already know about buying electronic gadgets in Hong Kong—by far the cheapest place in the world for 'em. HK is also a great place for clothes—providing you manage to get past the tailor in the hotel in Taipei where most of the group this last trip bought $150 custom-made suits (I bought two). Custom-made shirts are $10. You've seen the Seoul bargain fur ads in many American magazines.

In Sarawak you get some great batik paintings and batik shirts. I like the batik shirt I bought in Kuching so much I wear it just about all summer. Each country has interesting things to buy. The prices are surprisingly low—except in Manila where they are much, much lower.

Tell your wives that Sherry was with me on the trip and loved every minute of it. She will never forget our sitting at dusk by the Sarawak River having a "steamboat" dinner—all sorts of meats and vegetables you dip in boiling broth and cook at the table. It's a lot like shabu-shabu, if you've had that.

We also won't forget the short intense rain shower which dumped maybe four inches of water in an hour and then went away as quickly as it came. Sure, these Borneo countries are only about a hundred miles from the equator, but they're comfortable, running around 82–85 degrees year round. Don't bring your heavy coats—just a raincoat or umbrella for that occasional shower.

Let's see, I didn't mention a visit to the Korean Village, just outside Seoul—you'll need lots of film for this. It's a recreated old Korean village, showing how people used to live. There are plenty of food vendors and their food is superb—cooked while you watch.

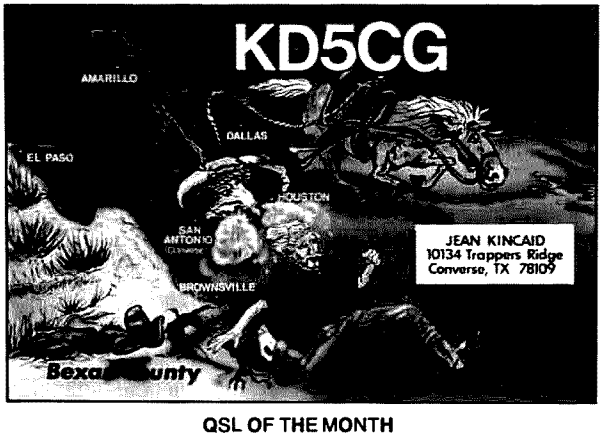
In Taipei you'll want to allow some time to see their incredible museum—and maybe, if you have the stomach for it, a trip to Snake Alley. Yecch. You'll certainly want to try a Wendy's hamburger at the Wendy's next to the hotel in Taipei and the one at Etweon in Seoul—the only Wendy's in the world I know of with hookers sitting around the tables looking for business. Yep, they serve Frosties there too. If you get hooked on Wendy's, there's a nice one in Hong Kong now, too, complete with salad bar. Lordy! It's all there, McDonalds, Pizza Hut, Kentucky Fried—even Chuck E Cheese's Pizza Time Theatre. Of course just down the street you can get a great Indonesian ristofle.

I'm trying to arrange to have some QSL cards we can take along with us—if I can get my print shop in gear. If you sign up in time we'll have your QSL cards for the trip—showing your six-country DXpedition on a map.

You'll have to make a decision on this early so Bob will be able to send a copy of your ham license to each of the seven countries involved and get the paper work done. These government bureaucrats don't rush for anyone, so get me a $1,000 down payment for the trip and eight copies of your ham license.

I am planning on personally escorting the DXpedition—so I'll be able to give you inside info on where to go, what to see, what to shop for, and what to do. Be warned that I also talk a blue streak and got surly the only time anyone out-talked me.

I have this peculiar problem—when I find something which is fun I have an urge to share my fun with as many people as possible. DX-



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

peditioning to Asia is just about the last word for a ham, so I'm pushing you to take the egg money and come with us this October.

If I don't get at least 50 DXpeditioners signed up by June 30th I'll have to just go by myself and look for you on 20m, eating your heart out.

Young hams, if there are any, shouldn't waste their money on a house or a car—they should invest it in the memory of a lifetime. Retired hams should dig into the sugar tin and get on this DXpedition while they still have some life left. Remember, the average life span of men these days is 72—which means that by the time you're 72 half your friends are dead and the other half are too sick to travel anymore.

So, as I asked in the beginning, are you ready to come with me—sit down at a rig in a rare country and face the pileups? Write to me—Wayne Green W2NSD/1, DXpedition '86, WGE Center, Peterborough NH 03458 USA, so we can get moving.

THOSE FOUR-LETTER WORDS

Mercy me, the good old days are back—I've just had an indignant letter complaining about my using four-letter words in my editorial—words like hell and damn. Well, the letter got me to thinking, so it wasn't completely wasted. Oh, as far as getting me to change my writing vocabulary, it was a waste. The purpose of words is to convey ideas, so I'm going to use what I feel are the appropriate words to express my ideas. When I'm expressing anger or exasperation, I'll be using words which convey my feelings—strong words.

There's a big difference in my mind between effectively communicating ideas and gratuitous cursing. Having spent several years in the Navy, I'm quite at home with everything our language has to offer in so-called dirty words.

Which brings me to profanity over the air—of which I am not a big fan. In case you haven't noticed, the FCC has backed off on this. Every attempt to keep broadcasters "clean" has resulted in our courts backing free speech. The end result is that legally, the last I heard, you can use any of the four-letter words you like.

Before you trot out your version of Navy language and bray it on 75m, let's think about this. When I hear someone using foul language, I hardly think s/he is very intelligent. We're just not used to hearing educated people talk gutter language. Note the term—gutter. That means the lowest possible class—gutter people.

Just as we dress for the impression it makes on other people—dress for success, as it were—we also use language for the impression it makes. People *do* judge you by your clothes when they see you. Conversely, you are showing people who you are by the way you dress. If you are a low-class bum you'll dress that way.

When we hear someone over the air the only way we have to judge that person is by the language s/he uses. We judge by their vocabulary, their accent, and the way they express themselves. Have you ever made a tape of your voice making a ham contact and then listened to it critically—listened as if this were someone else you were judging purely by what you're hearing? Tape recorders are cheap thse days—in fact, most of you have at least one around. Try taping yourself for an hour and see how you come out when you judge yourself.

We have a far from classless society. Indeed, class is something most of us are concerned with a good deal of the time. We judge people by how they dress and talk when we meet them. Are they above or below us in class? Oh, it's not usually a conscious thing, but we judge people and treat them accordingly.

Class has been fairly well described in many books. Vance Packard did a fine job of this a generation ago. Class is ingrained—it shows clearly in your clothes, car, house, furnishings, speech, recreation, the food you eat and drink, and your work. There are so many lifetime training factors involved that few people are able to change class. We're familiar with lower-class people who've gotten rich—the "Beverly Hillbillies" syndrome. We make fun of them.

When we hear fellow hams talking we can't help but look for clues as to class. We get 'em from their language. If we hear four-letter words—or even that dread 13-letter word—we know what you are. Remember, you only have one chance to make a good first impression—and when you're on

Continued on page 91

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LETTERS

WIRE ON FIRE

I found that the W3MT antenna bridge described in the April, 1986, issue does indeed put more fire in the wire. Running a mere two candlepower input, my CW signal is reported to have pegged the S-meter at ZS6NN. Amateur radio needs more revolutionary circuits like this one.

Howard Sahl WB8IWN
Lakewood CO

STONE STONER

I was in total shock and dismay over your support of RM-5241 (QRX, March, 1986) to take away the upper two MHz of our six-meter band for the creation of Don Stoner's Public Digital Radio Service (PDRS). Stoner's contention that "less than 1,000 are active on the band" is preposterous! The 2,500 members of the Six Meter International Radio Klub (SMIRK) and the approximately 300 repeaters on six (there were slightly over 50 in 1978) are evidence of this. There are a sizeable number of users of six in the club to which I belong (Goddard ARC) and if my calculations are correct there are *tens* of thousands of six-meter users. My interest in amateur radio began on six meters as a teenager in the middle seventies, primarily because of the varied propagation one can experience on the band. Six got me into amateur radio, and it can continue to lure others, particularly with the sunspot cycle headed upward.

Six is healthy, and use of it is growing. Recent access to the band by the British, with other European countries soon to follow, can only accelerate this growth. While there may be a lot of hams who don't use six, there are many of us out here who do. No, six meters is not dead; there are a lot of us out here who enjoy it, thank you. We intend to keep it that way.

Richard Penc NE2J
Laurel MD

Come on, Richard, there are barely tens of thousands of hams on the air to begin with, and you want me to believe that most of them are on six meters? I don't buy it. It seems to me that the current (and projected) level of activity could be handled in a 2-MHz-wide band. I think the overall benefit to ham radio from a PDRS outweighs the loss of a few MHz of spectrum.—KW1O.

CAN SCAN

I totally agree with the comment about the ICOM IC-02AT in the February issue. I bought mine a year ago and have found it to be an extremely nice radio, but its scanning speed leaves much to be desired! With today's technology I can't understand why it scans so slowly. I've noticed the speed of my friend's Kewood HT; it greatly outperforms the 02AT in the scanning department. Could you do an article on how to speed it up?

Chris Suleske N4LZG
Stafford VA

While you're waiting for the speed-up mod, check out the article by AL7DS in this issue to find out how to cover 144 to 165 MHz on your 02AT.—Ed.

DSB NEEDED

Glad to see Wayne back in the arena, handling the flaming sword in defense of the radio amateur!

AM is through, we must recognize, but SSB is very difficult to home-brew, especially outside the United States, due to troubles finding crystal filters and so on. I think that double-sideband (DSB) might be the answer we are looking for. It's much easier to design than SSB, with no crystal filters—beginners could have their fun again! What the world needs is an easy-to-build transceiver—make it DSB!

Carlos Vianna Carneiro PY1CC
Rio de Janeiro, Brazil

Let's forget the PDRS on six meters and give 52–54 MHz to the AMers and DSBers. . . they can QRM each other as much as they like, and I bet nobody would miss them on HF.—KW1O.

THE GREAT EXCLUDER

I usually agree with you concerning amateur radio. We need to get the rest of our hobby's members to open their eyes and ears and put their brains into gear and look into the future of our pastime.

I am a retired Air Force flyer. I have been teaching in the electronics program at East Tennessee State University for the past few years and have watched many a potential ham go away, probably never to return. We offer a course in ham radio, for one semester-hour credit. The student must earn a Novice ticket and make contacts on the university radio station. The course is conducted by K4SE. The results have been so-so.

I have conducted several Novice classes over the past few years and, to tell the truth, I feel that most of it has been a waste of time. Several people have obtained their licenses, but to my knowledge only one has used it. He has upgraded and is active. The rest, put bluntly, have no desire to use the code and don't even give it a try.

We worry that we will let the wrong element into ham radio if we relax and drop the great excluder, CW. I have news for the worry warts: We are doing what we want to avoid by keeping the code as an entry requirement. It is a common practice for one person in a group to go get a legit Novice ticket, then upgrade to General and then get all his friends into the hobby via the Novice route. They are usually into electronics and computers and have no trouble getting a Tech. ticket. Most of them make good hams. It's a shame we force them to be unethical to get into our hobby.

I hope you can get back on the bandwagon and lead us on. We need to badger the ARRL and FCC until we get the no-code through. If we don't, I'm afraid our hobby is doomed.

Why did I become a ham? It sure wasn't to communicate! I wanted to be able to fly my model airplanes and be able to conduct legal on-the-air experiments with radio control. Involvement with hamming in the traditional sense came later. I was involved with emergency communications in the early 60s when a hurricane ripped up the outer banks area of North Carolina. AM on a BC-610 from the MARS station. I don't get on the air very much even though I have 160–2 all-mode capability. When I do it I'm usually working some Novice. I get a thrill out of being the first contact for a new ham.

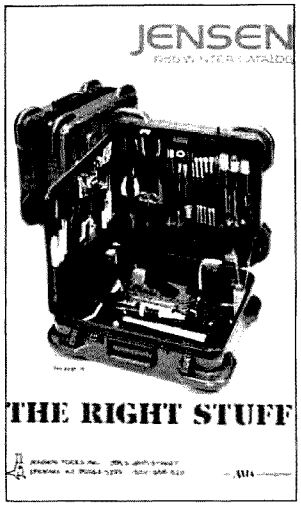
In teaching we try to develop a rationale for learning from the point of view of the student. If the student does not have a good reason for learning, he will not learn much. If he does have, you can't help him enough. We must find a reason why Joe Ham in the United States should want the no-code ticket and the thousands of new hams it would attract.

I have not heard much discussion about the influence that the Japanese no-code ticket had on the availability of ham gear in the United States, but I'll bet not many of us have thought about it. More hams will bring more crowding on the bands. Yes. But it will also bring more makers into the equipment markets and more and better equipment for us to buy. When we develop the newer techniques such as spread spectrum, as we did with SSB, the congestion will disappear. The new people will bring with them new ideas and we will all benefit.

One last bit: I teach a course called electronic circuit fabrication. The typical student comes into the course with the usual fears of not being able to do it, and then after a few successful laboratory experiences, during which skills such as soldering, wire-wrapping, parts testing, and such are introduced, the student becomes enthusiastic about it. We go from a schematic to a completed project that must include a PCB. When the semester is over, we have a group that has found the joy of making something that works and is ready to give something else a try. Too bad we exclude them from ham radio with Morse code. If we don't make room for them in our bands, someone else will! Remember 11 meters?

Donald H Lettrell W4VBH
Bluff City TN

NEW PRODUCTS



Free tool catalog available from Jensen.

NEW JENSEN CATALOG

Jensen Tools, Inc., has released its latest catalog featuring many additions to the Jensen line of tools, tool kits, and test equipment.

The 82-page catalog is available free from *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85044; (602)-968-6241.* Reader Service number 157.

KALGLO CONDITIONED UPS

Kalglo Electronics has added a new standby uninterruptible power supply to their Aegis™ line of power-conditioning equipment. The model LS250 Line-Saver-SREGTR uses pulse-width modulation to regulate the 250-Watt rms ac output for greater efficiency under various load conditions. The PWM ac output also increases battery efficiency to extend backup time: 5–10 minutes at full load, 20–25 minutes at half load, and 35–40 minutes at one-third load.

The unit comes with an internal 12-V sealed rechargeable battery, two voltage-surge-protected ac outlets, and audible and visual power failure indicators. The suggested retail price is $549.

For more information, please contact *Kalglo Electronics Company, Inc., Dept. CP, 6584 Ruch Rd. E. Allen Twp., Bethlehem PA 18017; (215)-837-0700.* Reader Service number 159.

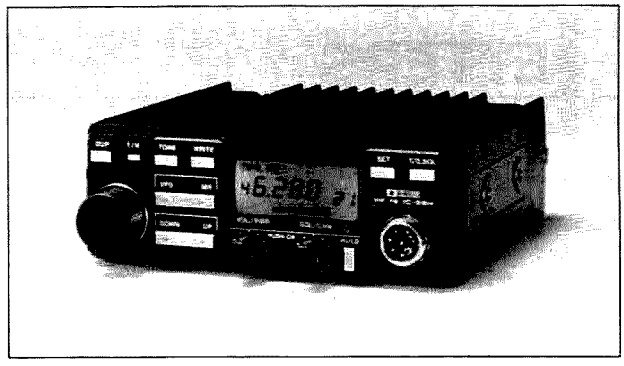
LOW-TEMP ALUMINUM BRAZING ROD

Medford Specialized Services markets an aluminum brazing rod for repairing and welding aluminum, copper, and brass joints. The rod's low melting point (732 degrees) makes it easy to use with a propane torch. Low-resistance joints may be formed on antennas, tank circuits, and matching networks as simply as soldering.

For further details, contact *MSS Wonder Rods, N3401 Castle Rd., Medford WI 54451.* Reader Service number 153.

ICOM HIGH-POWER 2M MOBILES

ICOM has announced two new packet-compatible 2m mobile rigs, the IC-28A (25 Watts) and the IC-28H (45 Watts). Both radios are small, only 5-1/4″ x 5-1/2″ x 2″ (the IC-28H is 7-1/4″ deep). They feature a large liquid-crystal display with automatic dimming, wideband (138–174-MHz) coverage for MARS and CAP operation, 21 memory channels, and band or memory scanning.



ICOM's IC-28H 45-Watt 2m mobile transceiver.

For more information, contact *ICOM America, Inc., PO Box C-90029, Bellevue WA 98009-9029.* Reader Service number 152.

OVONIC SILENT GENERATOR

Ovonic ThermoElectric Company, a division of Energy Conservation Devices, Inc., is now marketing the Compact Silent Generator. This lightweight, silent, solid-state generator obtains its energy from any source of heat and can produce up to 6 Watts of dc at 9 volts or up to 5 Watts at 6 or 12 volts. The CSG can directly power light loads or be used to charge external batteries.

For complete information, write or call *Ovonic ThermoElectric Company, 1864 Northwood, Troy MI 48084; (313)-362-3140.* Reader Service number 154.

ACTICON MINI RS-232 PORT

Rapitech Systems, Inc., has developed a DB-25 connector which includes a complete RS-232 communication circuit. The Acticon™ connector was designed to free up space on computer circuit boards by placing all of the hardware necessary for RS-232 communications inside the DB-25.

For complete details, contact *Rapitech Systems, Inc., 75 Montebello Rd., Suffern NY 10901.* Reader Service number 156.

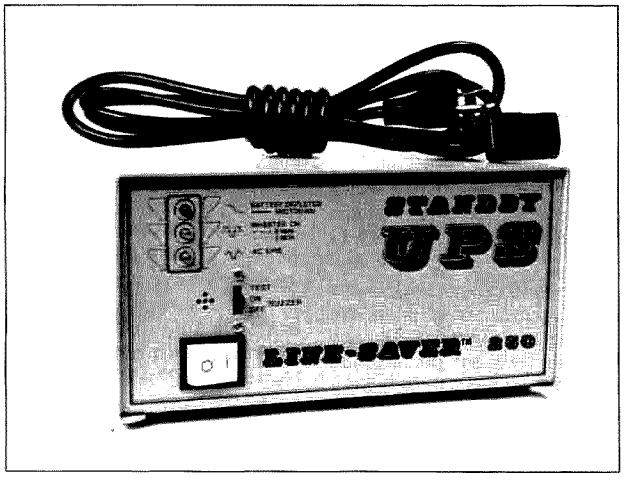
ETRON RF NOTES 3

Rf Notes 3, Volume 1 is a new software package from Etron Enterprises which aids in the design of Butterworth-response filters to the seventh order. Based on network modeling, the program designs low-pass, high-pass, band-pass, and band-reject filters as a function of input/output impedance ratios and user-defined input parameters. The output of the program is a schematic diagram labeled with circuit constants.

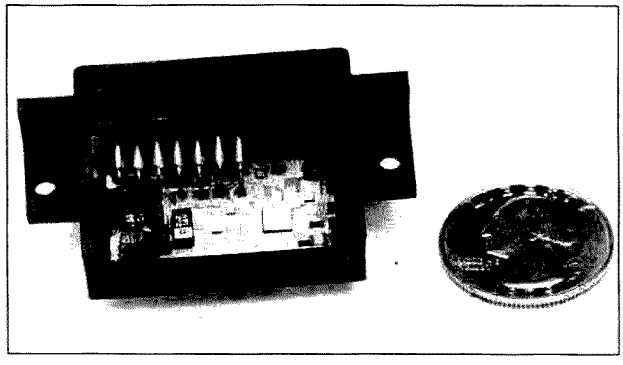
Rf Notes 3, Volume 1 is available for IBM DOS 2.1; for further details contact *Etron Rf Enterprises, PO Box 4042, Diamond Bar CA 91765; (714)-594-8741.* Reader Service number 158.

LARSEN 450-MHZ KULGLASS™ ANTENNA

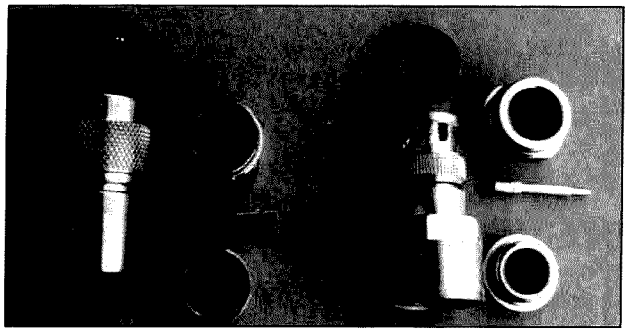
Larsen Electronics has announced the model KG-450 on-



The LS250 standby UPS from Kalglo Electronics.



The Acticon active connector from Rapitech Systems.



Nemal connectors for Belden 9913 and 8214 cables.

glass antenna for the 450–512-MHz range. The KG-450 is a half-wave, unity-gain element without a ground plane, and offers up to 2.4 dB gain in most mobile installations. The antenna is tuned by cutting the whip according to a chart provided by Larsen. The antenna kit includes 14 feet of RG-58A/U low-loss coax.

For more details, write or call *Larsen Electronics, PO Box 1799, Vancouver WA 98668; (206)-573-2722.* Reader Service number 161.

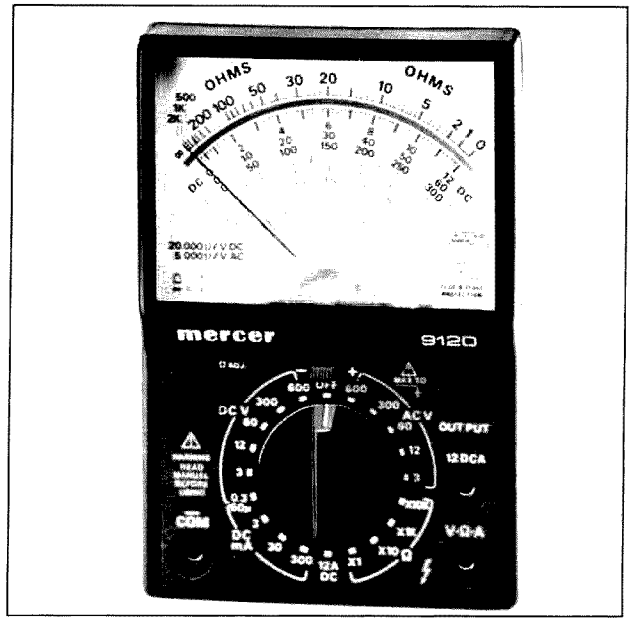
NEMAL CONNECTORS

Nemal Electronics has introduced a new line of connectors designed to fit Belden 9913 and 8214 style cables. The connectors are available in both type-N and BNC and accommodate a 9-1/2-to-11-gauge center conductor. Both styles meet MIL-C-39012 specs and incorporate silver-plated contacts and Teflon™ insulation.

For more information, contact *Nemal Electronics International, 12240 NE 14th Avenue, North Miami FL 33161; (305)-893-3924.* Reader Service number 155.

MERCER VOM

Mercer Electronics, a division of Simpson Electric Co., has introduced the model 9120 VOM. The new instrument features 25 ranges (including dB), 20,000 Ohms/volt dc sensitivity, 5,000 Ohms/volt ac sensitivity, and a frequency response of 100 kHz on the 3-, 12-, and 60-volt ac ranges. The model 9120 will measure up to 12 Amps dc.



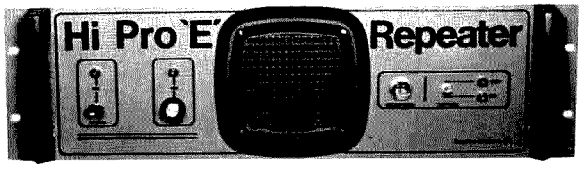
The Mercer model 9120 VOM.

For additional information on the model 9120 VOM, contact *Mercer Electronics, 859 Dundee Ave., Elgin IL 60120; (312)-697-2265.* Reader Service number 160.

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WRITE OR CALL FOR OUR COMPLETE CATALOG

Head-to-Head: Kenwood's TS-811A versus ICOM's IC-471A

by Peter H. Putman KT2B

ICOM America, Inc.
2380-116th Avenue NE
Bellevue WA 98004
IC-471A—$799

Trio-Kenwood Communications
1111 West Walnut Street
Compton CA 90220
TS-811A—$899

Here's the dilemma: You'd like to get on the 70-cm band, and in a big way. You've set your sights on weak-signal operation, ATV, OSCAR, and even some FM repeater and simplex operation. Then you read in a VHF column that "nothing beats using a transverter with your multimode HF transceiver." Sounds Good! Then you discover that using a transverter with your HF radio at best yields only about 4 MHz of the band to play with in the vicinity of 432 to 436 MHz. Hey, that won't work at all!

So you peruse the catalogs and come across the wonderous 70-cm multimodes various manufacturers (all Japanese) make and see that they'll give you what the transverter scheme won't—full band coverage and all modes. A quick call to the local authorized distributor and soon you're the proud possessor of one of these beauties. Bet it set you back a piece of change, too!

Now you're busy chasing OSCAR contacts and tripping repeaters all over the area, wondering why anyone would prefer the transverter route. Good question, and among those which this review will try to answer!

For this review, I obtained two off-the-shelf 70-cm multimodes from local amateurs, to ensure that what I evaluated is what you'd be likely to buy. I wasn't able to obtain the Yaesu FT-726 with 70-cm module, but at least you'll get an idea how the state-of-the-art from ICOM and Kenwood compare to your present setup—not to mention each other! No doubt about it, these radios will set you back a few dollars. Are they worth it? Let's find out.

A Comparison of Features

The ICOM 471A lists for $799. For this, you get 25 Watts rf output, dual vfo's, 32 independent programmable memories, and three different scanning modes. The Kenwood TS-811A lists for $899. This buys you 25 Watts rf output, dual vfo's, 40 independent programmable memories, and three different scanning modes. Pretty close so far.

Both radios offer USB, LSB, CW, and FM operation over the 430–450-MHz band. Both have continuously adjustable power output. Both are capable of ac operation (an ac power supply is standard on the TS-811A, whereas on the IC-471A it's an option) and can use "scanning" microphones for remote tuning. That's where the similarity ends.

ICOM and Kenwood have, in their own peculiar ways, included and excluded from these radios certain features that you might either wish to have or have no use for whatsoever! In many cases, the feature present on one radio is missing or unavailable on the other. Perhaps the best way to show this is with Table 1.

Obviously, there's a difference of opinion here regarding just what the 70-cm operator needs in a multimode transceiver. It makes it more difficult to review the units from a comparison standpoint, as well! When possible, I'll touch on how well these features worked for the particular radio under test.

Photo A is a front view of the two radios. They're comparable in size, with the ICOM being slightly larger. Both displays are easy to read and contain a multitude of information regarding operating mode, scan mode, RIT position, simplex/duplex operation, and tuning speed on the vfo. Both employ push-button function and mode selection.

Here's where I make my first subjective evaluation: The TS-811A's multifunction buttons make its front panel somewhat confusing, and it takes a second to find your way around the rig. On the other hand, the IC-471A is very user-friendly, and anyone could begin to use this radio right out of the box without referring to the manual.

Speaking of manuals: I've gotten quite used to the strange English that peeks through Japanese manuals on occasion. However, there is no excuse for the spelling errors in the

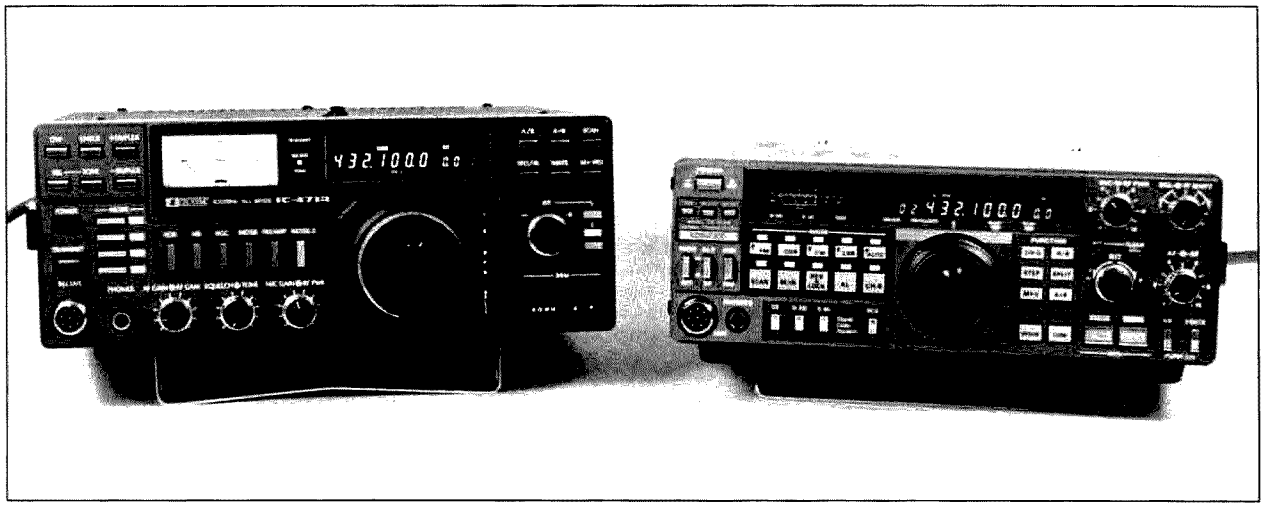


Photo A. The ICOM IC-471A and Kenwood TS-811A 430-MHz transceivers.

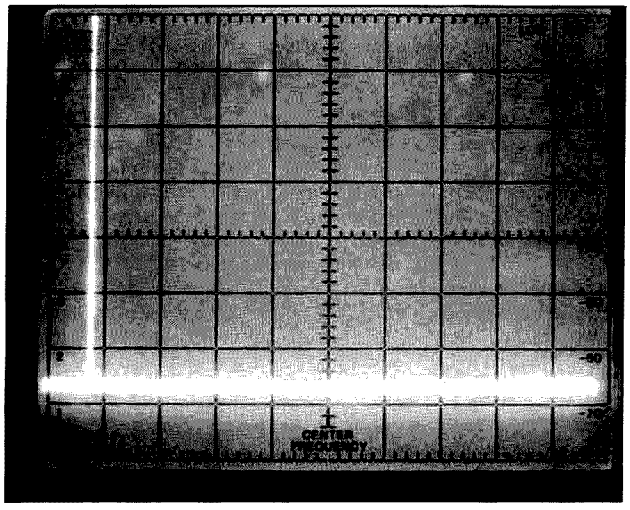


Photo B. Spectral display of the TS-811A running 25 Watts at 432.100 MHz. The second harmonic is down more than 70 dB.

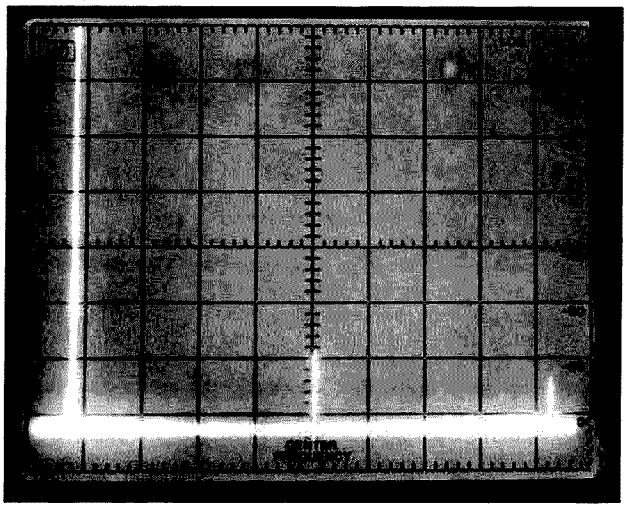


Photo C. Spectral display of the IC-471A running 25 Watts at 432.100 MHz. The second harmonic is down 60 dB.

TS-811A manual. Come on, guys! "Microporcessor?" Both manuals are fairly thorough, to their credit. The Kenwood manual is quite detailed regarding the front-panel controls and the use of the vfo's, memories, and scan features. The ICOM is equally thorough with its explanation of the front-panel controls, but it uses fewer words to get the job done.

Both radios have the complement of bells and whistles you'd expect for the price. The ICOM's bells and whistles, however, have more practical value and Kenwood's are more hi-tech for technology's sake. (I'll elaborate on that momentarily.) Kenwood has also included its new DCS (Digital Coded Squelch) system, which is becoming standard equipment on its VHF/UHF radios. Since it didn't compare to anything on the ICOM, I chose not to test and review it.

The Kenwood TS-811A

Okay, on to the controls! Starting with the Kenwood, one feature I found downright clever is the switch marked CH.Q. When you press this switch, the vfo dial steps in 5-kHz increments with a positive detent feedback through the dial—it really clicks with each step! Apparently, this is accomplished with a solenoid system, as you hear a rather loud relay "click" when you press the switch. With the switch out, the vfo dial tunes silky smooth in 10-Hz increments. I've never seen anything like this before on any radio!

The FM, USB, LSB, and CW push-buttons provide for more multimode selection. In addition, the Morse verification through the speaker of the push-button selected is useful if you're not looking at the radio directly. Next to this control is one marked AUTO, which automatically selects the mode of transmission depending on where you are in the band. Only problem is it's based on some sort of Japanese band plan that doesn't jive with ours, at least below the OSCAR subbands, so this control is useless and can be ignored.

Below these buttons are controls for SCAN start/stop; M.IN to save memories; REV & LOCK to lock up the dial and provide for reversed offsets in memory channels 36, 37, and 38; AL to turn on/off the channel 1 priority circuit alert; and CH.S to operate the channel-select position for dialing up memories. Phew!

On the right of the vfo knob are controls for the previously mentioned CH.Q function, A/B to select the two vfo's, STEP to select tuning rate, SPLIT to split the vfo's, M>V to transfer data from the selected memory to the vfo, and A=B to reset the two vfo's to each other. Below these are controls to select either vfo or memory position and a control marked COM, which is for a preset frequency of 433.000 MHz (apparently some sort of simplex net frequency in Japan). You can reprogram this if necessary.

The complement of controls is rounded out by a continuously variable RIT control, which a second switch from the front panel can cancel. RIT excursions are in the range of 9.9 kHz either side of center frequency. Also found are MIC and RF PWR controls, IF SHIFT, SQL for squelch, noise blanker, AF gain, RF gain, Up/Down 1-MHz frequency selection, and VOICE for an optional VS-1 voice synthesizer.

On the far left, two of the three tiny switches select repeater offsets and subaudible tones (with the optional TU-5 board installed); the other activates the tone circuit. Below these are three larger switches for speech processing, ALC meter display, and ACC—which activates a rear-panel connector with dry-contact closures rated at 0.2 Amps. Enough switches for you? I thought so.

And, would you believe with all that there's no front-panel transmit/receive switch? Instead, you have to either insert a subminiature plug and switch into the rear-panel jack marked ST BY or use the PTT switch on the microphone. (Why do you need a separate T/R switch? How about when you're checking swr on antenna lines! Since the TS-811A has no VOX circuit, you need to use the ST BY circuit to switch to transmit when operating CW. A front-panel switch would have been more convenient!)

Kenwood receives another bad grade for using a "UHF" SO-239 connector instead of the standard type-N at this frequency. Come on, Kenwood. Type-N connectors aren't that hard to make up. At least ICOM doesn't think so, as they did use a type-N fitting on their antenna connection. (But I'm getting ahead of myself!) Other rear-panel connections include external speaker, Key jack for a CW key, ACC 1 for a computer interface, ACC 2 for an external RTTY interface (this wasn't quite ex-

Feature	Kenwood TS-811A	ICOM IC-471A
Speech processor	Yes	No
Adjustable agc	No	Yes
Noise blanker	Yes	No
Transmit switch	No*	Yes
RIT	Yes	No
Preamp option	No	Yes
I-f shift	Yes	No
VOX operation	No	Yes
Multi-speed tuning	Yes	Yes
Ac power supply	Included	Option

* See text.

Table 1. Feature comparison.

plained in the manual), and finally, ac and dc power connections.

As I said earlier, the TS-811A comes with a power supply as standard equipment. One note here: The owner of this radio, Bill DiCarlo KA2QEP, mentioned that the area around the power supply gets quite hot when it's been on for awhile.

I didn't notice that the transformer became dangerously hot over a two-hour period, but it did get very warm, so I would recommend adequate ventilation when using the internal supply. If the unit must be in a confined area, use a muffin fan to keep cool air flowing through the supply. Bill mentioned that other TS-811A users mentioned this condition as well when he worked them on OSCAR, so apparently the problem is not isolated.

The ICOM IC-471A

Enough of Kenwood. Let's go over to the ICOM and review its controls in the same fashion.

Starting with the front-panel layout, you see concentric controls for AF/RF GAIN, SQUELCH/TONE (yes, an actual tone control on receive audio!), and MIC GAIN/RF PWR. Directly above these are push-button switches for VOX, noise blanker, AGC time constant, METER (in FM it's a discriminator meter), PREAMP for the optional AG-1 mast-mounted preamp, and mode selective scan, which selects only those stored memories for the mode in use to be scanned.

Directly to the left of these controls are the mode switches (FM, USB, LSB, and CW) and the desired front-panel TRANSMIT switch. Above it are the offset write control, CHECK control (a repeater reverse switch), +Duplex and −Duplex switches, tone encoder control, and tone select (which selects the subaudible tones available on the built-in subaudible encoder).

To the right of the vfo are controls for tuning speed; dial function select, which chooses either vfo or memory-select operation; SPLIT to split vfo's; UP/DOWN for stepping through the band in 1-MHz steps; a continuously variable RIT that has an excursion range of 9.9 kHz either side of the center frequency. Finally, the upper right corner contains the A=B, A/B, WRITE, SCAN, VFO/M, and M>VFO switches, which function as their counterparts on the TS-811A do.

The display on the 471A contains a lot of information similar to the TS-811A display and is equally easy to read. It displays frequency in use, along with the mode selected, offsets, memories in use, tone switch on, and RIT engaged with frequency excursion displayed. The vfo selected is also displayed.

Looking at the rear panel, you find the antenna jack (type-N), CW key jack, dc power socket, external speaker jack, and the provision for an optional computer interface unit, as well as the cover plate for the optional IC-PS25 power supply which fits quite snugly inside the transceiver.

Now for the human engineering part: The IC-471A wins hands down when it comes to the sensible layout and engineering of its controls. Nothing is confusing, and the most needed and frequently used controls are the biggest and are very accessible. The two hams who accompanied me to our test lab site felt much the same way—that the Kenwood had way too many "bells and whistles" and was confusing to operate. I did like the detent tuning option on FM built into the TS-811A, however. It's quite easy to overshoot your intended station with the silky smooth dial on the IC-471A, which isn't needed when tuning in FM stations 15 kHz apart.

The fact that the IC-471A is a bit larger doesn't hurt either! Having more room to space out all of those controls makes selecting them less confusing. Call it what you will, I maintain that the IC-471A is simply more user-friendly.

The Kenwood does get good marks for the audio reinforcement of the mode selected via audible Morse code. This feature is good when changing to SSB from CW during a contest and making sure you've picked the right sideband. The vfo dial is very smooth and a little tighter than the IC-471A dial, which I prefer since it's similar to the vfo knob on my Kenwood TS-430S.

Performance

Now let's move on to performance evaluation. For the critical tests, I used a Hewlett-Packard 8640 rf signal generator and 8554 Spectrum Analyzer with a 141T i-f unit. The power source was an Astron RS35M at 13.8 volts dc. The output of each radio was fed through a 200-Watt, 30-dB, 50-Ohm attenuator and into the analyzer for transmitter spectral purity measurements.

As you can see from Photo B, the Kenwood is phenomenally clean! It exceeds the FCC requirement of spurious emissions, being more than 60 dB below the carrier. We couldn't find the second harmonic! The IC-471A, on the other hand, just barely made the FCC spec (see Photo C) and hovered right at the −60-dB mark as shown on the scope display. The third harmonic is not much more attenuated at −65 dB.

Both radios feature continuously variable power output. In the minimum position, the TS-811A had 1.8 Watts of rf across 50 Ohms. This swung smoothly up to a maximum of 28 Watts with the control at maximum. On the IC-471A, the minimum power was 6 Watts; with the control fully open, the power output was 30 Watts. Both radios met the claimed power specification of 25 Watts. These tests were made with a Bird Model 43 wattmeter, using a 10- and a 100-Watt slug into a Termaline coaxial resistor and short 9913 coaxial jumper.

Receivers

Now, on to the receivers. We first evaluated minimum discernible signal (MDS) on both receivers. For the TS-811A and the IC-471A, that number was the same at −140 dBm, or .023 uV. A reading of S1 took .26 uV of signal on the IC-471A, while a similar reading on the TS-811A required .5 uV. Neither radio met its claimed performance specifications for sensitivity (less than 0.30 uV for 10 dB S+N/N for the IC-471A and less than 0.14 uV for 10 dB S+N/N for the TS-811A), although the ICOM was a bit closer.

In FM mode, the MDS for the TS-811A was −130 dBm (.07 uV), while the IC-471A needed −123 dBm (.16 uV) to register. The TS-811A achieved full quieting signal (20 dB of quieting) with −103 dBm or 1.5 uV of signal, and it took the same amount to create 20 dB of quieting on the IC-471A. This figure was not as good as ICOM claimed, and the Kenwood didn't measure up either.

Selectivity and Sensitivity

As regards selectivity, both radios passed with flying colors and exceeded their claims. For the TS-811A, selectivity of more than 2.2 kHz @ −6 dB in SSB/CW and more than 12 kHz @ -6 dB in FM was in agreement with our measurements. Same thing for the IC-471A, with claims of more than 2.4 kHz @ −6 dB in SSB/CW and more than 15 kHz @ −6 dB in FM mode. These radios are selective, indeed.

Squelch sensitivity was next. For the TS-811A, the claim was less than 0.16 uV at the threshold level. We measured .2 uV in SSB/CW, and .09 uV in FM mode. On the IC-471A, the claim was less than 1.0 uV in SSB/CW mode and less than .3 uV in FM mode. We showed .23 uV to break the squelch in SSB/CW and .1 uV in FM mode. Incidentally, the S-meter readings varied wildly between units. It took .026 mV to register S9 on the IC-471A and .01 mV to make the grade on the TS-811A. Finally, we measured FM bandwidth to be about 9 kHz on the IC-471A with some noticeable distortion and 7 kHz on the TS-811A with noticeable distortion.

Summing up, both radios exaggerate their sensitivity claims, but are better than their claimed selectivity figures. Both units would definitely benefit from a well-designed preamplifier ahead of the front end. (The front end in the TS-811A is a 3SK129, while the IC-471A uses a 3SK48 MOSFET.) There's no reason why these units could not have been outfitted with a well-designed GaAsFET front end. Kenwood is already putting GaAsFETs in its 144-MHz FM rigs! The 3SK48 is a good MOSFET, but it really doesn't have the noise figure of a good microwave transistor or GaAsFET. The casual user might not notice the difference on FM, but it'd be very obvious in the SSB/CW mode. My advice? Buy a good external preamp.

Testing

Last but not least, I put the units on the air for comparison. The control station was my Kenwood TS-430S with a Microwave Module ahead of it, using a microwave transistor in the front end. I used a Bird Coaxial Switch to instantly switch the antennas—4 x 21 element F9FT beams—to the three radios.

Reports were surprising. Using identical microphones on the TS-430S and TS-811A, the stations I worked preferred the audio quality of the TS-811A better. But the IC-471A gathered the best reviews for audio with the standard HM-12 microphone from every station polled except one. I discovered that the speech processor made little or no difference on the TS-811A as compared to the TS-430S. The IC-

471A, of course, has no processor. Received audio sounded best to me on the TS-430S, with the TS-811A second and the IC-471A a distant third. The unit really does need the tone control, as the ICOM's audio is very bassy on receive.

I measured the starting frequency to be 432.100 for our tests, confirmed with the station on the other end using a counter. The display on the TS-811A read 432.100.1 and the IC-471A read 432.099.2. We noticed some drift on both radios, and after about one hour, my TS-430 system and the listening station's system were still on frequency to each other at 432.100, but the 471A had to be readjusted to 432.099.1 and the 811A to 432.100.3. Acceptable, considering the frequency.

I switched to CW and all three radios received nice reports for the waveform with no perceived key clicks. The TS-430 and IC-471A both offset nicely in the CW mode, giving the listening station an 800-Hz note. The TS-811A had no offset whatsoever and had to be tuned in to obtain the beat note, which is a pain in the neck. A steady signal to produce an S9 +10 signal here on the TS-430S registered about S7 on the TS-811A and S9 on the IC-471A, confirming our previous measurements. As stated earlier, the agc is adjustable on the IC-471A but not on the TS-811A, being selected with the mode in use, so I couldn't evaluate it fairly.

All told, the two multimodes performed about as I expected against the transverter/HF-radio combination. Both multimodes really need preamplifiers to make the grade on 70 cm. Both acquitted themselves well in a short period of FM repeater operation, receiving good audio reports. Note that the microphone gain on FM with the TS-811A is fixed and not controlled by the front-panel MIC control! Now, why the heck is that? It's adjustable in all modes on the IC-471A, which is a real plus. Another strange engineering design from Kenwood, perhaps?

The Final Evaluation

Overall, if I had to buy one or the other, I'd go with the ICOM IC-471A over the Kenwood TS-811A for two reasons: First, the front panel is very well laid out and the controls easy to use. Second, the receiver is a bit more sensitive than the TS-811A, and ICOM makes a companion mast-mounted preamp for the unit, which Kenwood either doesn't make or isn't importing at this time. The quality of the ICOM transmit audio also impressed me.

Although the Kenwood has some clever features and by far the cleanest transmitter, I wouldn't use most of the bells and whistles in day to day operation, and they are so closely integrated into the basic operation of the radio that they become somewhat confusing. I will say in its favor that the TS-811A has a nice feel on the vfo and the channelized detent tuning option is great to have on FM, as opposed to a smooth spinning dial.

Thanks to Joe Dolan KA2KWS for the use of his IC-471A and to Bill DiCarlo KA2QEP of QEP's Electronics for the use of his TS-811A.■

MFJ-1270 TAPR-2 Packet TNC

by Marc Stern N1BLH

MFJ Enterprises, Inc.
Box 494
Mississippi State
MS 39762
MFJ-1270—$129.95

At last, someone has made packet radio available to the common ham. MFJ Enterprises of State College, Mississippi, has introduced a TAPR TNC-2 clone that's every bit as good, if not better, than the original.

And, in what may come as a surprise to many who expected the MFJ unit to work well but be inexpensively made, the MFJ-1270 Packet Radio Terminal Node Controller (Photo A) is a very well made unit. MFJ has done it right.

Look at the printed circuit board (Photo B). It's a class act and definitely not a simple phenolic board. Instead, it is double silver-plated with plated-through holes. The motherboard looks as if it comes right from a computer room. All of the components are socketed, which is another plus because it allows you to keep up with the latest changes in software. All MFJ has to do, in this case, is burn new programmable read-only memory chips and send them out to customers who can then insert the new software.

As it is, the MFJ TAPR-2 clone has the latest revision of the TAPR-2 software. The date on my evaluation unit read 12/30/85, and I have to believe that this is the latest or one of the latest revisions of the TNC software.

A tiny unit, it is 7-3/8" wide by 1-1/2" high by 9-1/2" deep, and it weighs about two pounds. This puts it on a par with other low-powered, portable units on the market. In fact, the MFJ TNC is built to run off 13.8 V dc. That means it is perfect for portable low-power operation, such as in an emergency when you have to move and handle high-speed traffic in the field.

It's a far cry from the TNCs of a year or so ago that were anchored to 120 V ac and wall outlets. This definitely limited the effectiveness of the TNC.

Essentially, the MFJ board is a plug-and-play unit. Since it contains the latest TNC program, all you need is a computer and a terminal program in the computer. The TAPR board acts as if it were a remote system—which it is, really—and the computer communicates through its telecommunications program with the TNC. You don't need any special program to use the MFJ TNC because everything is built in.

Connecting the TNC and computer is easy because a standard serial interface has been implemented. This means that a straight-through RS-232C cable attached to a serial port will work quite nicely. MFJ also includes an eight-pin Kantronics-style connector and cable, as well as a five-pin DIN cable with which you connect your radio and the TNC.

A series of DIP switches on the rear (see Photo C) sets the speed of the TNC's serial port. I left the evaluation unit set for 1200-baud, a 7-bit word length, and 1 stop bit. I then reconfigured my computer's communications software to conform, which was the easy way of doing things from my point of view.

You needn't do it that way, of course, because the TNC is actually a tiny computer in its own right. And since it is a computer, it's programmable. That programming is handled via the built-in terminal software used by the TNC to communicate with the computer. You hit the CTRL-C combination (on an IBM PC, anyway) which puts you into command mode where you can set just about any parameter you care to think of—including word length, parity, and the like.

This programming also sets up the TNC for use at your station. Your station's call is used as the TNC's identifier to the packet network. It recognizes the standard AX.25 network protocol and, like any TNC, will also act as a digipeater, as well as a beacon. This feature is

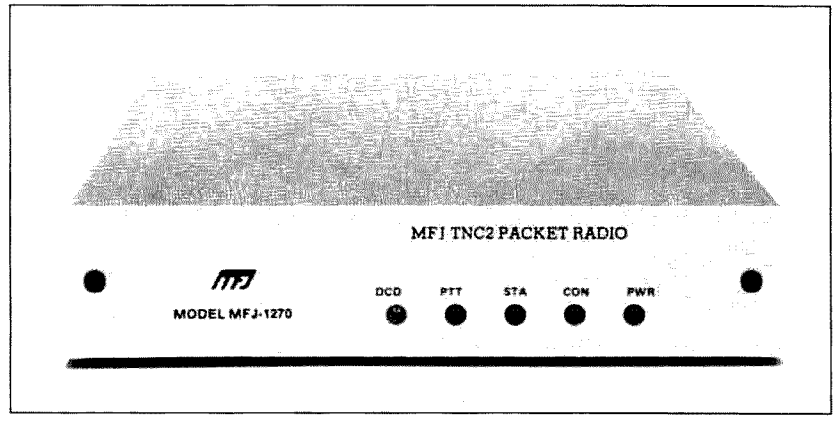


Photo A. The MFJ-1270 TNC-2.

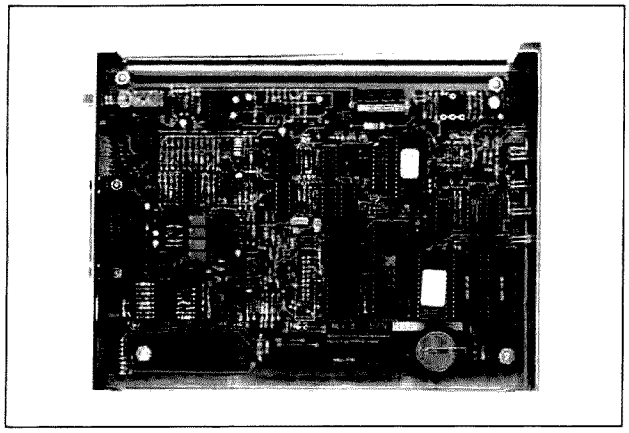


Photo B. The printed circuit board.

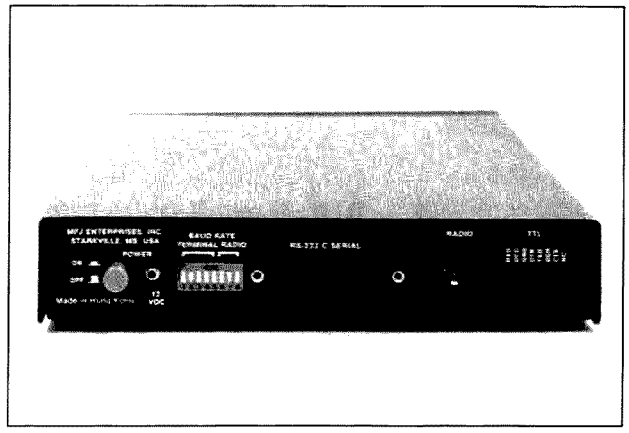


Photo C. A rear view of the MFJ-1270.

user-selectable, as is the TNC's ability to recognize both V 1.0 and V 2.0 of AX.25. Just about every feature of this TNC is user-selectable.

The CPU of the MFJ-1270 TNC-2 is a Z-80. It is backed by 16K of RAM and 32K of ROM. The ROM holds the monitor routine for the TNC, as well as the firmware program. The RAM is the user scratchpad.

There are so many features to the TNC-2 that I'll just have to touch on the highlights. In action, the MFJ-1270 TNC-2 is ready to go right from the box. It's simply a matter of wiring up a microphone connector for your VHF FM rig and putting it on the air. MFJ notes correctly in its manual that using the TNC in this manner is inconvenient if you use the rig for FM phone work, too. It offers an interface box which allows you both packet and phone options. It looks like a good idea. Not only does MFJ offer such a unit, it also gives you the schematic so you can build your own. It's a nice touch.

I found that the 1270 was set up to work correctly from power-up. To MFJ's credit, though, the manual does tell how to remedy problems if the tones aren't set up correctly.

The switching time of my evaluation 1270 matched the Kenwood TR-7930 with which it was primarily used. Both the radio and the TNC handled my input with no problems. I used shielded cables for all the cabling; this also helped ensure reliability because it kept noise interference to a minimum—which can be a problem when you're dealing with cabling several pieces of computer equipment together. I suspect ribbon cable would create noise problems and would urge anyone considering packet to use shielded cabling.

I did run into one problem, though, when it came to cabling, and that was due to pilot error. As most hams do, I usually attempt to do something before reading the documentation thoroughly. Most of us will read enough to find the on-off switch and then start playing.

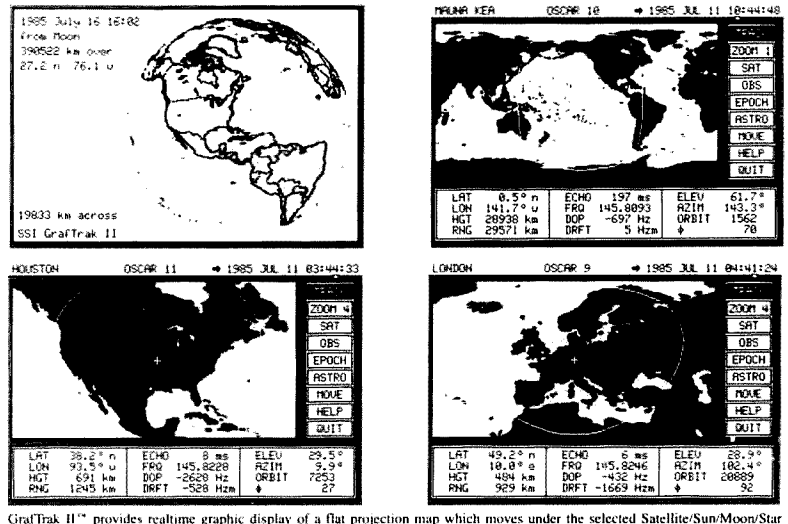
I did this with the 1270 when it came to cabling up the microphone connector, then followed the diagram rather than reading the text closely. After I had finished wiring the cable, I found it didn't work. When I read the documentation, I found that it noted that cables would vary from the diagram and that each buyer would have to check out the connections with a volt ohmmeter for continuity. The only correction I would urge is keeping all the cabling the same or just providing a DIN connector and a picture of the 1270's requirements. Leave the color-coding off the diagram because many people will follow it rather than read the documentation.

The manual is the best I've ever seen from MFJ. Over 200 pages long, it is readable and covers every aspect of the TNC from interfacing (with a comprehensive discussion of serial interfacing for major computers through setup—and a two-part tutorial) to a detailed discussion of the command set and error messages, as well as a technical discussion of the TNC. It also covers—as do all of MFJ's manuals—the TNC's theory of operation and provides a comprehensive set of schematics.

MFJ has done it and I still wonder how. The Mississippi ham radio manufacturing firm has brought in a sub-$130 TNC that's worth much more. It deserves a look by anyone serious about packet. Reader Service number 152.■

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A Walk Through the VHF/UHF Spectrum

KT2B surveys ham radio's biggest allocation—the bands and modes above 50 MHz.

In this article, I'll try to provide a brief but concise overview of the amateur spectrum space above 50 MHz. In doing so, I'll try to answer questions such as: (1) How many frequencies do we have up there? (2) Who's using them? (3) How can I (the reader) better use them? (4) Who makes equipment for those bands anyway? (5) You mean I can actually work England and South America on 6 meters?

Actually, we in the amateur service are quite fortunate with our spectrum allocations. Table 1 shows the most active bands. The only group with access to more spectrum space is the U.S. government itself! Yet, much of this spectrum space lies largely dormant, either due to ignorance or just laziness. As time marches on and pressure mounts from groups outside the amateur radio service, we'll be hard pressed to justify retaining these privileges unless we make better use of them, for as you well know "possession is nine-tenths of the law!"

The 6-Meter Band

For starters, consider the lowest frequency allocation: 6 meters. This band occupies the frequencies from 50–54 MHz and is a rather unusual animal. For example, although it is truly a VHF band based on spectrum position, it often behaves like an HF band owing to different types of propagation that may occur. The most common is sporadic-E, *Es* for short. This condition is prompted by sunspot activity and results in sporadic ionization of the E layer of the ionosphere. (Typical HF propagation occurs in the F layer of the ionosphere.) When this happens, contacts may be made with stations located thousands of miles away, often with low power levels. Severe thunderstorm cells frequently accompany this phenomenon, which has been extensively researched over the years.

A type of propagation that occurs less frequently nowadays on this band is F2 layer propagation, similar to that which occurs on the lower frequencies. Right now, the sunspot cycle has bottomed out but is climbing up again; so in about five years, F2 propagation will be at its peak on this band. Here the possibilities are greater for DX: It's quite common to work into Japan from the West Coast or into England and Africa from the East Coast. One fine example of what F2 can provide is a contact made by Mike Crawford WA2VUN from his home in N.J. to a ZL in New Zealand, running 80 Watts to a single seven-element yagi.

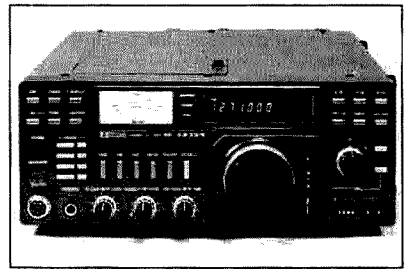


Photo A. ICOM's IC-1271A 1.2-GHz transceiver.

Many 6-meter fans have WAC certificates, largely due to F2 propagation. Now that amateurs in Great Britain have received 6-meter privileges (although somewhat limited), it will be possible to make the W2-G2 contact path more readily when the sunspot cycle peaks out. Many stations have already worked the British Isles via Es, which occurred several times last summer, forming paths from the Atlantic Coast states 3,000 miles across the sea to England. With the eventual abandonment of TV channel 1 in Europe in favor of UHF color channels, most of the continent should receive the 50-MHz allocation in time for the next sunspot peak, providing new DX enjoyment for 6-meter types.

Aside from these modes, another popular form of DX and one that takes a considerable amount of skill is Meteor Scatter, which involves the use of ionized meteor trails to reflect 50-MHz signals over several-hundred-mile paths. It takes a lot of patience and repetition to make a scatter contact since most of these meteor "bursts" or "pings" are very short in duration and occur during the early morning hours or during intense meteor showers.

Normal 6-meter propagation is on the order of a few hundred miles at best. You can detect enhanced propagation by watching TV channel 2, 3, or 4 for distorted, breaking-up video with heterodyne beats as another distant signal is received. Often during Es, the distant signal will replace the local station completely for a few minutes, and you'll have the rare pleasure of watching a Miami weather report on your screen in Cleveland! (Neighbors who know you're a ham will blame *you* for this condition by attributing it to TVI!)

For the average station, 50 to 100 Watts and a single five-to-seven-element yagi will do the trick for SSB/CW work. The higher your antenna, the better. (This also helps to reduce possible TVI, as the increased vertical spacing between your 6-meter antenna and the nearby TV yagi also increases the attentuation of out-of-band overload products.) Most transceivers made for 50 MHz could stand the help of a good, well-designed MOSFET preamplifier with 12–16 dB of gain. Some of the transceivers available (like the ICOM 551/551D series) make provision for such a preamp.

Don't let TVI scare you away from the band, either. In many areas, the penetration of cable service has all but eliminated this problem (assuming the system operator runs a clean shop!). Most often TVI is caused by using high-gain yagis and placing them at the

same height as most of the neighboring TV antennas, which is just asking for trouble. Get it up in the air as high as you can! Of course, there's no reason why you can't go 6-meter mobile or portable with horizontally polarized antennas as well, and take advantage of the nearby hills to chase DX on 50 MHz.

Another mode of operation that has achieved some popularity on the band is FM operation. Although there aren't many, 6-meter repeaters are distributed throughout the United States and can be accessed with a few Watts from a portable or mobile rig. When Es is present, you can have quite a time with FM, working through repeaters hundreds of miles away! Unfortunately, there aren't too many FM mobile rigs being made these days by the major manufacturers, so you'll have to dig around to see what you can come up with used. The 50-MHz band is a valid allocation in Japan; so, when the sunspot cycle was at its peak, we were flooded with all sorts of 6-meter radios—portables, mobiles, and multimode base stations. They're still around at flea markets for a good price.

Right now, the choices for new 50-MHz radios are somewhat limited to the ICOM 551D, ICOM 505, and Yaesu FT-726R with 6-meter module installed. You can also go the transverter route with Microwave Modules' MMT-50-28 or 50-144 units, the new Mutek TVVF-50 transverter, or kits from SSB Electronics and Hamtronics. Used radios that fit the bill include the Kenwood TS-600, Drake TR-6, Heath SB-110, Yaesu 627RA, and ICOM 560 mobile radios. Portable choices include the ICOM 502 and the Yaesu FT-690. Kenwood and Yaesu also make transverters to match their HF radios, which you can often purchase very reasonably. Antenna manufacturers include KLM, Hy-Gain, and Cushcraft. Sources for amplifiers are somewhat limited. Mirage is the only U.S. manufacturer making a 100-Watt solid-state unit at this time—perhaps more will come on the market as the sunspot cycle approaches its next peak.

6 METERS	
50.000–50.100	CW, Beacons
50.100–50.500	CW, SSB, AM
50.110	Calling Frequency
51.000–51.100 and 52.000–52.100	Pacific Calling Frequency
50.500–54.000	FM and Repeaters
53.1, 53.2, 53.3, 53.4, 53.5	Radio Control
2 METERS	
144.000–144.050	EME (Moonbounce, CW only)
144.050–144.060	Beacons (CW)
144.060–144.100	CW
144.100–144.300	SSB, CW
144.200	Calling Frequency
144.600–144.900	FM Repeater Inputs
144.900–145.100	Simplex, Packet
145.100–145.500	Repeater Outputs
145.800–146.000	OSCAR Mode B Outputs
146.000–148.000	FM, Repeaters
1-1/4 METERS	
220.000–220.050	EME (Moonbounce)
220.050–220.060	Beacons
220.060–220.500	SSB, CW
220.110	Calling Frequency
220.500–222.000	Link Frequencies
222.000–223.300	Mixed Use (all modes)
223.300–223.500	FM, Repeaters
70 CENTIMETERS	
430.000–432.070	EME (Moonbounce)
432.070–432.200	CW, SSB
432.110	Calling Frequency
432.200–435.000	Mixed Use, Link Frequencies
435.000–438.000	OSCAR Inputs (Mode B), Outputs (Mode L)
438.000–440.000	ATV, ATV Repeaters
439.250	National ATV Simplex Frequency
440.000–450.000	FM, Repeaters
23 CENTIMETERS	
1260.000 MHz–1270.000 MHz	ATV, FM, Mixed Use
1269.000 MHz	OSCAR Mode L Input
1270.000 MHz–1290.000 MHz	Mixed Use, FM, Repeater Inputs
1295.000 MHz–1297.000 MHz	CW, SSB
1296.090 MHz	Calling Frequency
1297.000 MHz–1300.000 MHz	Mixed Use

Table 1. Modes used on the most active VHF/UHF bands.

The 2-Meter Band

Moving up the dial, switch your attention to the 144-MHz or 2-meter band, as it is more commonly called. This is the most densely populated amateur allocation in the entire world, largely due to the phenomenal popularity of FM and repeater operation. It's also the band on which the OSCAR Mode B downlink frequencies are located. In North America, South America, and Japan, the 2-meter allocation runs from 144–148 MHz, while in Europe it's limited to 144–145 MHz.

Normal propagation is considered to be line of sight on this band, and with gain antennas and some power, the average distance worked is in the range of about 50–100 miles. Most of the activity on 2 meters consists of FM repeater operation, with SSB/CW operators usually found down around 144.100–144.200 MHz. Packet operators have carved out frequencies near 145.000 MHz for their simplex operations. Moonbounce types frequent the area below 144.050, and the OSCAR downlinks are in the range near 145.800 MHz. More equipment is sold for this amateur band than for any other in the world, as well!

Enhanced propagation on 144 MHz comes in many forms: First and most commonly encountered is tropospheric propagation, or tropo for shorthand. This phenomenon occurs when temperature inversions are present—that is, for a given increase in altitude, the air temperature actually increases instead of decreases. When this happens, layers of warm air are often sandwiched between layers of cold air and a duct is formed along the boundaries, carrying signals along much like a waveguide. Users of repeaters are very familiar with this condition in the late summer and early fall, usually in the morning hours.

Strong storm systems in the area can induce tropo, with the intensity of the ducting effect proportional to the areas of the cold and warm air masses as they overlap. Tropo ducts also form at higher altitudes, and stations below the duct are often unaware of activity inside the duct. In this country, most tropo occurs along the coastal regions—mainly the Atlantic Coast and the Gulf of Mexico, and the Pacific Coast to a lesser degree. The path from Hawaii to Southern California has been worked many times on 144 MHz via tropo.

A form of propagation that can show up at any time on 2 meters (and on 6 meters, as well) is aurora, which is related to sunspot activity. During auroral propagation, signals are reflected off the auroral curtain and received 800–1,000 miles away, depending on the intensity of the aurora. This type of propagation occurs more frequently at higher

latitudes, with stations in the Northeast, Upper Midwest, and Canada able to take best advantage of it most of the time. When aurora is very intense, stations from the southern United States will often be heard off the curtain.

Still another form of enhancement is Es, which occurs much the same way as it does on 50 MHz, but far less often. Usually strong storm cells over the Midwest and Southwest provide the best conditions for long-haul DX, observed mainly during the months of June and July. You can often detect sporadic-E by listening to FM broadcast stations or watching TV channels 7–13 for interfering stations outside the normal coverage area. The higher the channel it's observed on, the more intense the Es. A rule of thumb is to watch the Es on 6 meters, and when it becomes quite short—200 to 300 miles—move to 2!

Just as on 6 meters, you can work meteor scatter with patience and determination. It's more fruitful to pick a major shower to do it, though, as the pings from everyday meteorite trails are harder to detect than on 10 and 6 meters. Good, high-gain antennas and schedules are a must, as well as a fair amount of power to make it worthwhile. And as I mentioned earlier, moonbounce operation, or EME (Earth-Moon-Earth), is very popular on 2 meters. Stations here usually run large four-bay or larger antenna arrays with legal limit amplifiers to overcome the 200+ dB path loss from here to the moon. Low-noise GaAsFET preamplifiers find favor in this application.

There is a bewildering array of equipment for 2 meters currently available! At least eight Japanese and one U.S. manufacturer have FM handie-talkies available for the band, not to mention mobile FM radios. In addition, there is a preponderance of 2-meter multimode radios for both base station and car, as well as the world's only multimode handie-talkie (Santec LS-202). Three companies in Europe have gone the other route and manufacture transverters for the band, so as to employ HF multimode transceivers as i-f frequency TX/RX sources, most often in the 10-meter band. Examples of these would include the popular Microwave Modules' MMT series, as well as Mutek and SSB Electronics.

There's a plethora of antennas to choose from as well—KLM, Cushcraft, Jaybeam, CueDee, Hy-gain, and Tonna to name a few. Most users of FM employ vertically polarized antennas, such as ground planes and J-poles, while SSB/CW users employ horizontally polarized yagis, with as many as 19 or 20 elements. This is often the reason why newcomers to weak-signal work can't hear any activity, as they are still using their vertical arrays!

There are many manufacturers of amplifiers for 144 MHz as well, with Mirage, TET, Alinco, THP, and Microwave Modules being among the more popular solid-state models. Henry Radio manufactures several versions of a 2-meter amplifier using 3CX800 and 8877 tubes, which find use largely with the moonbounce set and weak-signal enthusiasts.

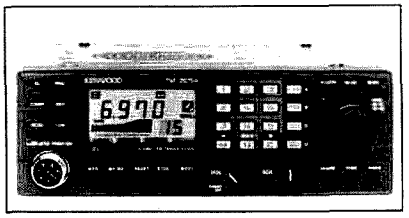


Photo B. The Kenwood TM-2570A 2m mobile radio.

As far as the OSCAR users are concerned, multimode transceivers for 432 MHz and 144 MHz or transverters are the order of the day, with "twist" polarization (antennas using both horizontal and vertical elements) yagis and 100-Watt amplifiers.

Two meters is a perfect example of what happens when amateurs take to a certain band and populate it: The amount of equipment available goes up in direct proportion! It's probably the most secure allocation we have above the HF bands, directly due to the activity. Unfortunately, the same cannot be said for the next band, 220 MHz, which has long been the stepchild of our VHF allocations. In fact, you can consider 220 MHz to be a UHF allocation in the scheme of things, lying above TV channel 13 at 220–225 MHz.

The 1-1/4-Meter Band

The 1-1/4-meter band is a rather unique allocation; in all the world, only we in North America can use it! This certainly explains the lack of commercially made equipment for the band, with nothing being manufactured here in the United States and the only transceivers coming in from Japan—where the allocation doesn't exist. At present, only ICOM makes a mobile FM transceiver for the market. Kenwood, ICOM, and Yaesu make hand-helds for 220, as well. In addition, for some time Hans Peters VE3CRU of Transverters Unlimited has been making modified 220 Microwave Modules that work with HF multimode radios. SSB Electronics is also introducing equipment for this market.

What can you work on 220? For one thing, the propagation under normal conditions closely resembles 144 MHz, with line-of-sight conditions being the rule on low power. With a gain antenna and some power, 50–100 miles is possible. Enhanced propagation takes several forms, with the most common being tropospheric propagation as on 2 meters. This occurs mostly from late summer through fall and can result in contacts in excess of 500 miles, mostly along coastal areas.

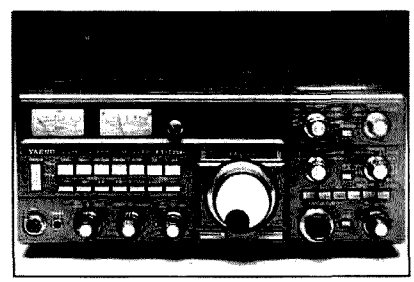


Photo C. Yaesu's FT-726R multimode, multiband transceiver.

During periods of sunspot activity, 220 contacts can be made via aurora, again in the same manner as 2 meters, with stations in the northern regions of the United States having the best propagation. Meteor Scatter is also quite popular on 220 during strong showers, such as the Perseids in early August. Again, schedules are a must here; otherwise, you'd never hear the minute-to-minute "pings" from random meteorites entering the atmosphere. As far as Es is concerned, there haven't been any strong documentable cases for it lately, though this will likely change when the sunspot cycle peaks out in about five years.

Operation on 220 mainly consists of FM and repeaters. In fact, many users of 220 have tired of the crowded conditions on 2 meters and have moved up to what they consider to be a more "civilized" band, especially in urban areas. In those areas, most of the coordinated repeater pairs have long been assigned, yet many of the machines are "dormant" much of the time. Down at the far end, you'll find the weak signal chasers and moonbouncers, with the former around 220.110 and the latter around 220.050. Moonbouncers in particular like this band since it is relatively "quiet" as opposed to its lower frequency brother. And with the band falling above TV channel 13, TVI is rarely, if ever, a problem, even with high power levels.

These advantages haven't been lost on other potential users of the band, so 220 continues under siege from a variety of special interests, who've come up with all sorts of "shared spectrum" proposals, as well as schemes to take the band away from hams outright and parcel it out to commercial users. The big problem is activity—there just isn't enough to ensure the long-term use of the band. So the big manufacturers in Japan are loath to come out with lines of full-featured multimode radios for 220, not trusting in its staying power. It's up to us to determine the fate of 220, and the old saw "use it or lose it" certainly applies here.

One group that appreciates the "quiet" on 220, as well as the abundance of repeaters, is the packeteers, who are multiplying on this band. Without the bother of continuous voice transmissions to contend with, the packet mode is a very viable alternative. Of course, the Novice Enhancement Docket before the FCC may change all of that, giving voice privileges on 28 MHz, 220 MHz, and 1260 MHz. It would result in more Novices on the band and in the long run may be what it takes to keep 220 in the amateur table of allocations.

As I said before, the equipment situation is somewhat tight. In addition to the 220 Microwave Modules, SSB Electronics will soon import a 220 transverter to the United States. As far as amplifiers go, Mirage and Tokyo HighPower make 220 units for 50–120-Watt



Photo D. Microwave Modules' MMT 144/28 R 2m multimode transverter.

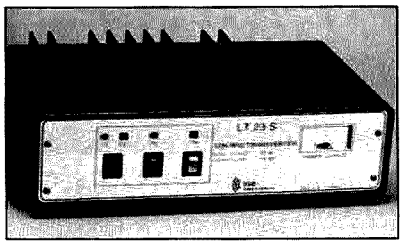


Photo E. The LT 23 S 1296-MHz transverter from SSB Electronics.

output, using HTs or mobile rigs as exciters. In the higher power range, Henry Radio makes a version of the popular 2004 for this band, using the 3CX800. Antennas are available from both Cushcraft and KLM, as well as mobile whips from Larsen. A good deal of the operators on 220 have rolled their own equipment, for obvious reasons.

The 70-Cm Band

Now, let's take a big step up to our next allocation: the 70-cm band, or 430–450 MHz. Originally, this band included the range 420–430, but recent FCC restructuring has removed the lower 10 MHz from amateur use. Here's a band that's larger than 6, 2, and 1-1/4 meters *combined*. It's also a worldwide allocation, so equipment is plentiful and not that expensive. Whatever your fancy—from weak-signal work to ATV, OSCAR, FM, and repeaters—there's plenty of room to engage in it on 70 cm.

Here is a true UHF band. Signals travel line of sight and can be affected by objects of varying density in the signal path, such as trees, buildings, and even clouds of moist air. Yet, since the 70-cm band is largely unaffected by sunspot activity (and subsequently any sporadic-E), it's a preferred choice for such services as commercial television in Europe. Since the wavelength is so small, high-gain multiple-element yagi antennas are possible using only 15 feet or so of boom length.

Propagation enhancement usually occurs via tropo. In some cases, it's so intense that astounding distances can be covered. For example, during the hurricane last September that hit along the East Coast of the United States, signals from Florida were heard into Connecticut and Massachusetts! Tropo ducting is quite common at this frequency, although you usually have to be up a bit in elevation to hook into the duct. Signals can also be worked via aurora on rare occasion, as happened this past February when intense sunspot activity resulted in auroral activity from 50 MHz through 432 MHz! Stations were heard working grid squares from the East Coast into Illinois, Ohio, Michigan, and Indiana via the "buzz."

Starting at the low end of the band around 432.010–432.050, you'll find the moonbouncers. This is a very popular band for EME since you can construct high-gain arrays that don't take up much room. Many European and Japanese EME enthusiasts go mobile or portable for their contacts, towing their arrays along on trailers. Power becomes somewhat more difficult to generate on 70 cm as many of the popular ceramic power tubes don't carry full ratings through 400 MHz. However, the problem of Faraday rotation, the slow shift of polarization on reflected signals from the moon, is less pronounced on this band. It takes longer for the wave to shift—often minutes—as opposed to 2 meters, where the shift occurs at a rapid rate.

Next, you find the weak-signal types around 432.110 MHz, the national calling frequency. SSB and CW work is plentiful on 70 cm, especially during contests. Many operators use multimode transceivers to cover these modes, and, of course, there are many transverters made for the band.

Going further up, you run into the OSCAR uplink frequencies in the range 435–437 MHz. These are the inputs for Mode B with corresponding outputs on 2 meters. The ATV crowd is next, for the 70-cm band is the lowest frequency allocation that permits Fast Scan Amateur Television. Many stations are on in color, and there are ATV repeaters located on tall buildings in urban areas.

Finally, you run into the FM crowd above 440 MHz. Like 220, the 440 allocations are largely used up in the major urban areas, but many of these repeaters are closed repeaters, using PL or tones to unlock the machine for use by members. The national simplex calling frequency on FM is 446.000.

As you might expect, there's no shortage of equipment to choose from on 70 cm. All of the major Japanese manufacturers make both hand-helds and multimodes for base and mobile operation. The major European manufacturers offer transverters for the band, as well as ATV transmitting and receiving converters. Since many of the radios on the market usually suffer from less-than-acceptable front-end sensitivity, there's an abundance of preamplifiers available for both station-mount and mast-mount application. Serious users of the band employ low-loss cables such as 9913 and hardline for transmission lines, since the average coax used at HF is too "lossy" here. Also standard in most cases is the use of low-loss 50-Ohm connectors, such as type N and BNC.

Amplifiers are also plentiful. Alinco, Mirage, TET, Microwave Modules, and Lunar make solid-state versions with outputs up to 140 Watts. For the higher power requirements, Henry makes the 2004 and 3004 using 3CX800 and 8877 tubes. Antennas are available through a variety of sources, including KLM, Cushcraft, Hy-gain, Larsen, CueDee, Tonna, and Jaybeam. OSCAR operators will employ the "twist" type of antenna for the uplink mode, while ATV operators will go for horizontally polarized yagis, along with the moonbouncers and weak-signal operators. All FM operation uses vertical polarization.

OSCAR Mode L, used less frequently than Mode B, employs uplinks on 1269 MHz and downlinks on 436 MHz. At this time, packet operation on 70 cm is sketchy at best. But due to the combination of spectrum space, worldwide popularity, and availability of equipment, 70 cm could easily become the next most popular band after 2 meters! Already in Japan, reports are made of the type of congestion we experience here on 144 MHz, with FM being again the predominant mode.

The 23-Cm Band and Above

Before closing, I'll touch briefly on the SHF bands, namely 23 cm and above. The 1260-to-1300-MHz band is coming on fast, especially in Europe and Japan. Here's a band that's twice as big as 70 cm! Again, the popular modes are SSB/CW, ATV, OSCAR, and FM. Propagation is essentially limited to tropo. I've never heard of any auroral contacts via 23 cm, although during the February conditions, there were those who certainly waited patiently to be the first!

Moonbouncers also like 23 cm since Faraday rotation is even slower here and they can construct high-gain arrays or dishes in a relatively small square area. Of course, power is more difficult to generate here, so most of the amplifiers you'll hear are home-brew, generally employing triodes such as the 7289/3CX100. Even 9913 exhibits high losses at this frequency, so hardline is the transmission medium of choice.

Equipment available includes the new ICOM IC-1271A 10-Watt multimode base for SSB, CW, FM, and ATV. ICOM also makes the IC-120 mobile FM radio with 1 Watt of output. Kenwood makes the TR-50 FM portable, also running 1 Watt from a self-contained battery-operated unit. High performance transverters are readily available from Microwave Modules and SSB Electronics, makers of the popular LT-23S 10-Watt transverter. GaAsFET preamplifiers abound at this frequency, since they are a necessary evil for serious weak-signal work.

Antennas are made by Tonna of France and Jaybeam. DownEast Microwave manufactures a fine line of loop yagis for 23 and 13 cm. Larsen makes a 23-cm mobile antenna, based on a cellular design for 800 MHz.

Most often, the inhabitants of this band like to roll their own antennas, but it's a tricky task as mast supports often exceed the length of the driven and parasitic elements! Hence, most users place the beams at the very top of their masts or make up side arms with vertical supports. Frequently, users of the band will experience reflection from such objects as airplanes and large buildings! Often refraction can occur over mountainous areas, and it's not unusual to hear lots of multipath on the signals when living in such an area.

At 13 cm, much the same conditions prevail, except very little is available for the band commercially except from Europe and a few specialty houses in this country. Loop yagis are very popular at this frequency, as are dish antennas. Transverters are available from such manufacturers as SSB Electronics of Germany, which sells a unit for 13 cm with an i-f at 144 MHz, running 3-Watt output. EME Electronics of Germany makes beautiful cavity amplifiers for both 23 and 13 cm, using two 7289 tubes to achieve 50-to-100-Watt output.

Amateurs have additional allocations at 10 GHz, 24 GHz, 48 GHz, and above, although it's hard to say who's active here other than the diehard experimenter and occasional contest stations. In addition, I've sidestepped the 902-MHz band, simply because it's such a new allocation that I'm not very familiar with it. I can tell you that there is activity on 902, as a repeater group was on the band the day it became available (from Texas—it figures!). SSB Electronics has indicated the availability soon of a 902-MHz transverter, as has Hans Peters of Transverters Unlimited. Many hams are modifying cellular equipment to cover this band with excellent results, seeing propagation similar to 23 cm.

Closing Remarks

That about covers our walk through the VHF/UHF spectrum, and as you can see there's plenty of room for expansion and experimentation. Indeed, these frequencies are the key to the future of the hobby, as we continue to try new modes that require greater bandwidths than our already-crowded HF bands can provide. If you haven't given one of these bands a try lately, why not pick up a transverter or HT and have a go! Many activities exist for the VHF/UHF operator, with no less than six national contests and many certificates to be had, such as the popular VUCC (VHF/UHF Century Club). It needn't take a lot of money, or a lot of space either. Set your sights high, for a change! ■

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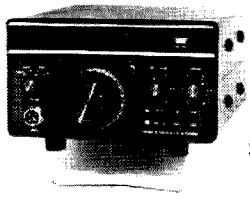


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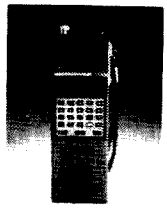
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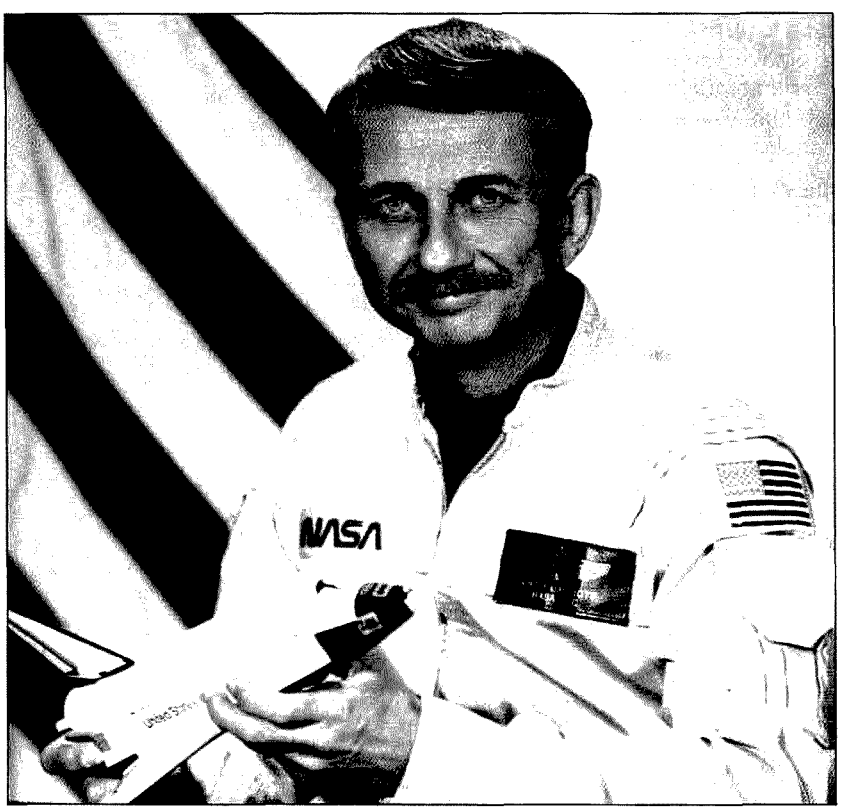
An interview with Owen Garriott W5LFL and Tony England W0ORE.

The theme for this month's issue is "Above the Crowd—VHF and UHF Operation." Well, two guys who have certainly been above the crowd are NASA astronauts Owen Garriott W5LFL and Tony England W0ORE. Owen and Tony both have carried amateur radio into orbit aboard the space shuttle; we asked them to reflect a bit on their experiences, and on the past, present, and future of ham radio.—KW1O.

Owen Garriott W5LFL

KW1O: Owen, how long have you been a ham?

W5LFL: A looong time! I was still in junior high school when my father came home and said, "Son, a friend at the office is going to be giving code classes—would you like to go down and learn the International Morse code with me?" So we started; I was in 9th grade.



Owen Garriott W5LFL.

Then a little while later it was, "How would you like to go to theory classes?" We ended up getting our tickets together...that was during the latter part of World War II.

KW1O: Was there a club at school?

W5LFL: No, not at school. As far as I know there was no one else at school who was interested in this sort of thing. I took my classes at the local club in Enid, Oklahoma.

KW1O: Did your interest in radio lead you to a career as an astronaut?

W5LFL: Yes, I think that ham radio took me into electrical engineering and radio propagation—the heart of amateur radio. After graduating from the University of Oklahoma I had a three-year Navy obligation, and then went back to graduate school at Stanford and ended up in the radio propagation laboratory. After that I stayed on the faculty doing space research based on radio propagation, sending satellite transmissions through the ionosphere. Then NASA said they wanted people with my sort of skills involved in the manned space program. There's a pretty clear line of interest going from that code class to my present job.

KW1O: How much trouble was there talking NASA into letting ham radio aboard the shuttle?

W5LFL: Well, it wasn't an easy job. It isn't so much convincing people that it's a good idea as convincing them that there's nothing wrong with the idea. There are so many people who can say no, and that's so much easier for them to do. It's simple to get someone to say, "Yeah, that's a great idea, I hope it works." It's a much tougher job to convince people that this great idea of yours is not going to cost more, or interfere with the schedule, or reduce the time that their experiment might get, or set a precedent, or any number of objections that can be raised. And all along they're saying, "That's a great idea, I hope it works." There were at least a half dozen wickets to get through before the project left the ground. It's also very important

to have people supporting your project that are well-respected in the system—General Abrams, who was at that time head of the Office of Manned Space Flight, and Roy Neal K6DUE come to mind.

KW1O: You used a special Motorola-built hand-held with a window-mount antenna. Did Tony [W0ORE] take the same rig up?

W5LFL: It was either physically the same unit, or one functionally identical.

KW1O: How did it work?

W5LFL: We had a little antenna that attached to one of the windows. Of course, the rig had been pretty extensively ground-checked for interference and so on. Overall, it functioned very well.

KW1O: Would you do anything different if you took ham radio back into space?

W5LFL: Well, you always try to build on what you've done before. I think that for the first effort on Spacelab 1 we did just about the right thing. There are a few details that I might have changed, like letting people know not to transmit on the downlink frequency, but I think it went off pretty well.

KW1O: You worked a heck of a lot of people.

W5LFL: Yes, over 300. For the second effort, Tony went beyond that and took up SSTV. For the next time we should try something like packet, or a fast-scan TV uplink with a slow-scan TV downlink. Part of the trouble Tony had was that he couldn't hold a signal long enough to get a full frame of SSTV. It would have been OK if only one person had transmitted at a time, but that's not a very satisfactory way to operate. With a fast-scan uplink you only need to hold the signal for less than a second.

KW1O: What are you involved with at NASA?

W5LFL: I'm working on the space station project, making sure that the station design is an appropriate one for the various kinds of activities we'd like to do on it.

KW1O: Will there be a ham shack on the space station?

W5LFL: I would be very surprised if there was not. However, it is premature to start pushing in that direction. I think we'll get it on the basis of providing off-duty activities for the crew. There's a very good chance we'll have one for that purpose. We won't know for certain for three or four years—the station is scheduled for launch in 1992.

KW1O: Sounds like you have your hands full. Is there much time for on-the-air activity?

W5LFL: No, not really. I get on the local [Houston] repeater now and then, but that's about it.

KW1O: Well, Owen, thanks for chatting. And good luck with the space shack!

W5LFL: Thanks, it's been fun.

Tony England W0ORE

KW1O: Tony, you've been a ham for quite a number of years. What got you started?

W0ORE: Well, I started when I was about twelve. A buddy of mine and I built a couple of "secret transmitters" that we took to school. We got the plans out of one of the ham magazines. They were small CW transmitters, and the speaker was actually a vibrator that you could put against your arm.

KW1O: You must have done pretty well in class!

W0ORE: It certainly kept our interest up! But ham radio for me has been a series of peaks and valleys; when my professional life is particularly busy, hamming slides a bit. And when there's a lull in my professional life, I pick it right back up. My wife Kathi has always appreciated my hobby—it tends to keep me home.

KW1O: Is Kathi a ham?

W0ORE: No, she's not. I've tried, but I can't talk her into it. Actually, Kathi bought my last rig for me. When I was at school working on my doctorate, she thought it would help me keep from climbing the walls. Kathi thought talking on the radio was a lot of fun, but she just wasn't interested in getting a license.

KW1O: I wonder if some sort of Novice voice privilege would appeal to people like that?

W0ORE: I haven't been following all of the various proposals, but I can say that I'm very much in favor of some sort of digital class of amateur license. There are a lot of people who could really benefit from being amateurs, and who would bring their special skills to the hobby. Of course, there will always be people around who feel that the old way is the best way.

KW1O: Have you read of Don Stoner's proposal for a consumer packet service on six meters?

W0ORE: Yes, I have. I'm concerned that the service would be outside of amateur radio, essentially setting up a separate system of ham operators. Even worse, if we did establish a non-code digital class of license within the amateur service, I can see them being treated as second-class hams until they "grew up" and got a "real" ham license.

KW1O: Tony, are you on the bands much these days?

W0ORE: Well, I have more time than I have facilities. My neighborhood doesn't allow antennas, so I have to hide them. Most of them don't work, so I put 'em up and tear 'em down. I had a pretty good 40-meter wire beam up for a while, but the last hurricane we had wiped out the oak tree that was supporting it. I built a trap dipole, wound the coils and everything; it was a lot of pain and the antenna didn't work worth a darn. So I've taken that down and my next one is another wire antenna with an open-wire feed.

KW1O: You're using ladder line?

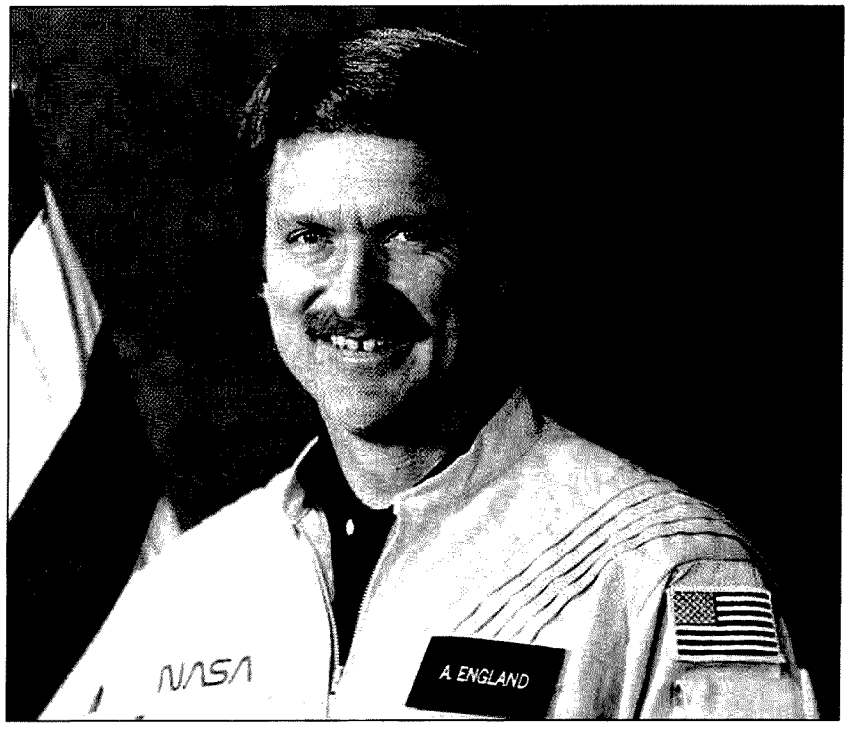
W0ORE: Oh, no, I'm going to make my own feedline. I've got about 30 of those little insulators and a big hunk of wire for it.

KW1O: You're one of a dying breed!

W0ORE: Well, I've got some spare time and don't know what to do with myself, so I thought I'd give it a try.

KW1O: I was surprised to read that your ham-in-space demo of slow-scan was the first instance of ground-to-spacecraft TV transmission. Doesn't the shuttle have two-way television?

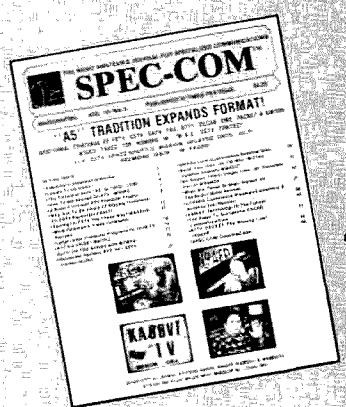
W0ORE: I'm surprised too. Considering all of its facilities, the shuttle really should have two-way video. Part of the problem is the way the ground stations are configured...they just aren't set up for video. We're going now to a satellite-based commu-



Tony England W0ORE.

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nications system—part of it is in place right now—and that might handle video. We have a sort of FAX unit on the shuttle, but the thing weighs a ton; it's really low-quality. A real monster.

KW1O: Since your SSTV demo went so well, is NASA looking into replacing the FAX unit with a slow-scan system?

W@ORE: No, they're not. It's not that they don't appreciate the good results we had with SSTV, it's just incredibly expensive to design a unit and integrate it into the shuttle. The most expensive part would be updating all of the documentation for the orbiter . . .there are enormous piles of manuals.

KW1O: Had you tried SSTV before the flight?

W@ORE: No, I hadn't.

KW1O: It went pretty smoothly, didn't it?

W@ORE: Yes, very smooth. There's a lot to it, with all of the various formats and such. I practiced quite a bit on the ground with the local club station, and that helped. We had about a dozen two-way SSTV QSOs from space.

KW1O: Were most of those with youth groups?

W@ORE: Actually, no. The youth groups were tough for slow-scan; by the time we had established contact on voice and answered the kids' questions and so forth, the orbiter was out of range. The orbit was low to begin with, and there wasn't a lot of time for SSTV frames.

KW1O: Did the kids come up with crazy questions?

W@ORE: No, not at all. Mostly "What is it like?" and "What does it feel like?" and "What do you see?" They wanted to know which experiments were working best, and what we were finding out that we didn't know before. They were really good questions.

KW1O: How did the unpublished frequencies work out? Was there any trouble?

W@ORE: No, not too much trouble. There were a few guys on them that shouldn't have been, but it worked out just fine. On the published frequencies, an interesting thing happened. I started out by working like Owen did. I would listen for a minute or so, and then transmit all of the calls that I had heard during that minute. What happened was that nobody was stopping to listen to me! I would get some callsigns, and transmit them down, and the next minute these same guys would still be calling! I said, "Hey, this isn't going to work," and started doing it contest-style, acknowledging stations one at a time. That seemed to work much better. I also found that I really didn't need all of the channels on the radio. I think maybe two or three would do, so I could QSY if some ham had switched his receiver off.

KW1O: Gordon Fullerton made some QSOs. Is he psyched up for ham radio again? [Gordon once held a Novice license.]

W@ORE: Well, I tried to have that happen. He enjoyed making the contacts, but I don't think he's going to run out and get a license.

KW1O: Tony, it's been great talking with you.

W@ORE: Likewise, Perry. 73!■

Frank H. Perkins WB5IPM
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Two to Ten

Plug into the excitement of 10 FM—your HT is the key!

Ten-meter FM is a unique operating experience. It combines the convenience of channelized operation with frequent DX band openings. Mobile operation is very successful on 10-meter FM, as just a few Watts of transmitter power are needed for direct DX contacts. Furthermore, a number of high-performance repeaters are now in service to support 10-meter FM operation worldwide.

While many of the new HF transceivers feature FM as a standard or optional mode, the availability of inexpensive low-power equipment for mobile or portable operation is somewhat limited. A number of hams have successfully adapted low-band commercial FM rigs and CB transceivers to 10-meter FM operation. Often, however, one or more of the following desirable features is found to be difficult to implement in such a conversion: tuning of all 10-meter FM channels, direct and repeater mode selection, good quality audio, and clean limiting (good noise rejection) in the receive mode.

This article presents an alternate approach to 10-meter FM equipment—a 2-meter-to-10-meter transverter. "2 to 10" is designed to translate the operation of a 2-meter FM transceiver to 10 meters. All the features of the 2-meter transceiver (synthesized tuning, memory, scanning, touchtone™ pad, etc.) can be used on 10 meters. 2 to 10 includes both direct and repeater offset modes. The inherent audio quality of the FM transceiver is preserved in its translation to and from 10 meters. The transverter operates from 12 to 14 V dc, making mobile and portable operation straightforward. 2 to 10 was designed with 2-meter HTs in mind, but it should work with any modern 2-meter FM transceiver with a low power output in the 150-mW-to-1-W range.

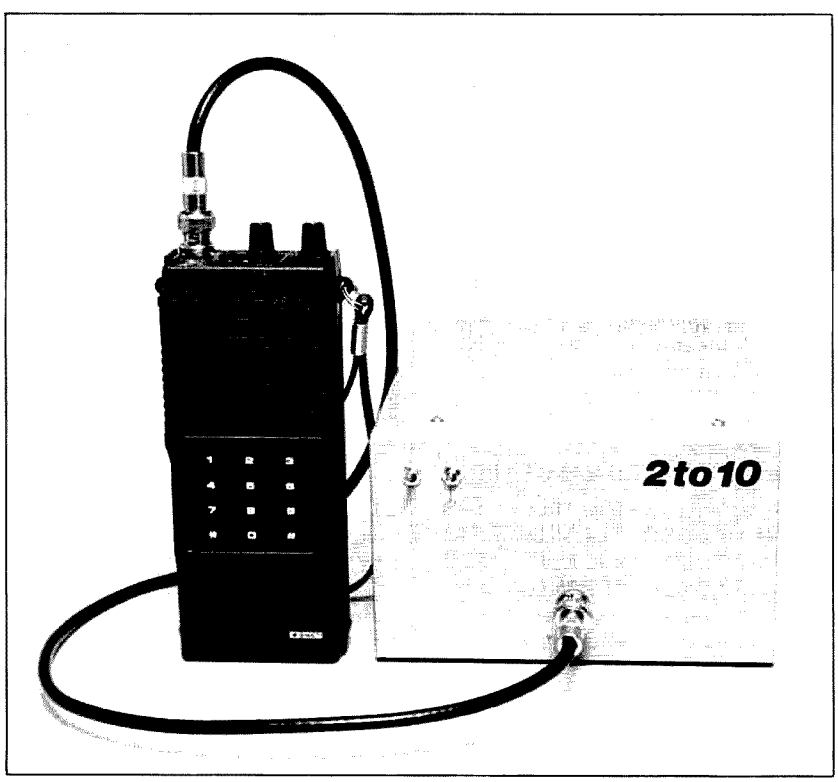


Photo A. 2 to 10 is a transverter that places your 2-meter FM rig on 10-meter FM.

2 to 10 uses low-cost components which are readily available from suppliers that cater to the individual rf experimenter. Construction costs for 2 to 10 run about $65, not counting junk-box discounts. If you already have a 2-meter transceiver, 2 to 10 can be an effective and inexpensive approach to getting on 10-meter FM.

Operation

When using 2 to 10, the 2-meter FM transceiver is placed in the direct (simplex) mode and is set for low power. The 2-meter transceiver is operated in the frequency band of 146.40–146.48 MHz. 2 to 10 translates this frequency band to 29.60–29.68 MHz for direct operation and offsets the transmit frequency −100 kHz for repeater operation. Note that the repeater offset is done by 2 to 10; the 2-meter rig is *always* operated in the direct (simplex) mode. Increasing the frequency setting on the 2-meter transceiver increases the operating frequency on 10 meters a like amount. (Note that this is different from satellite translator operation; do not get confused.)

Block Diagram

Let's first look at 2 to 10's block diagram, Fig. 2. We will then look at the circuits in

each block in detail. A dummy load is provided to present a reasonable match to the 2-meter transceiver during transmit. T-R switch circuitry senses the presence of 2-meter rf power and switches 2 to 10 to the transmit mode. A small sample of 2-meter rf is mixed with the local oscillator (116.80 MHz for the direct mode or 116.90 MHz for the repeater mode) in the transmit mixer, developing a difference frequency at 10 meters. Tuned circuits in the mixer and preamplifier stages reject other unwanted mixer outputs. The driver and final-amplifier stages boost the 10-meter output to about 3.5 Watts. The rf output is then low-pass-filtered and output at the 10-meter connector.

In the receive mode, the incoming 10-meter signal is mixed with the local oscillator (always 116.80 MHz for receive) in the receive mixer, developing a sum frequency output on 2 meters. This signal is bandpass-filtered and applied to the 2-meter connector.

The local-oscillator chain consists of a 58.4-MHz oscillator, a doubler stage, and switching to route the local oscillator to either the transmit or receive mixer. One or two crystals are switched in to control the oscillator, depending on the mode of operation. All T-R and rf switching is solid state.

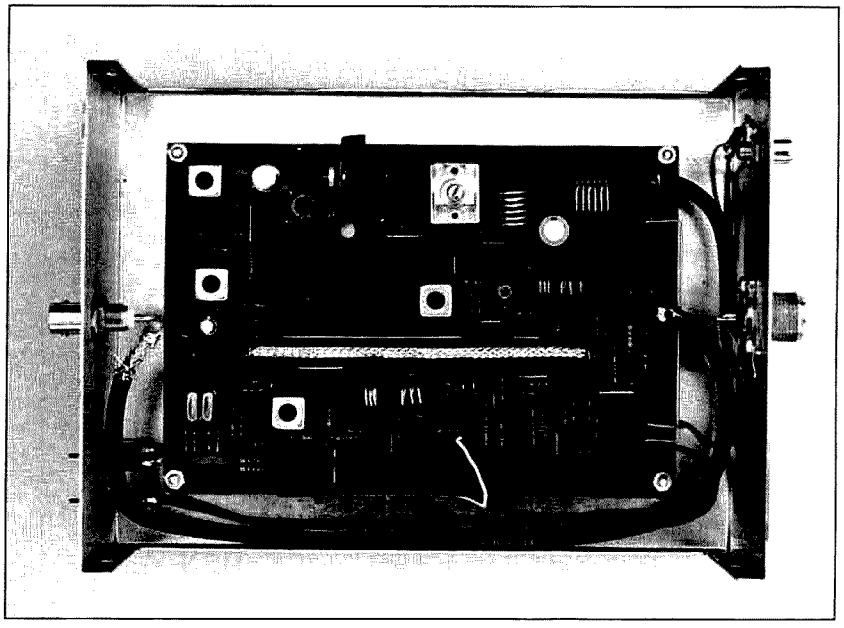


Photo B. Interior view of 2 to 10.

Dummy Load and T-R Voltages

For the following discussion, please refer to the schematic diagram, Fig. 3. R1 and R2 provide a dummy load for the 2-meter transceiver. When transmitting, R38 delivers 2-meter rf to the clamp network consisting of CR15-CR18. These diodes level the rf voltage detected by CR19 and C35 for various input power levels within 2 to 10's operating range. The detected rf switches Q8 on, which switches Q9 on to provide +T voltage. At the same time, Q8 switches Q10 and Q11 off, dropping the +R voltage. During receive, Q8 and Q9 are off and Q10 and Q11 are on, so that +R voltage is provided instead of +T. The diodes used in the T-R circuit are 1N914s or equivalent. The MPS2222 and MPS2907 are inexpensive plastic-package versions of the 2N2222 and 2N2907.

Transmit Chain

During transmit, R3 supplies 2-meter rf to clamping diodes CR1 and CR2, which provide a leveled rf signal of about 1.6 V p-p. This signal is further attenuated by the R4-R6 network and applied to gate 1 of Q1, a 3N211 dual-gate MOSFET mixer. About 3.5 V p-p of local-oscillator voltage is applied to gate 2 through C2. C4 and T1 resonate at 29.6 MHz, the 10-meter difference-frequency output of the mixer. The signal level across C4-T1 is about 600 mV p-p. Q2, an MPS918 rf transistor, provides about 20 dB of voltage gain, and C36-T2 provide additional filtering. Driver Q3 provides another 17 dB of gain. Broadband transformer T3 provides a suitable match between the collector of Q3 and the base of Q4. R14 helps ensure driver stability, as the 2N3866 is a high-gain device. Q4 further amplifies the 10-meter FM signal to about 3.5 Watts. The transistor chosen here is a rugged and inexpensive 2SC1909 which is used in many CB rigs. Broadband transformer T4 provides a suitable match between the 50-Ohm antenna load and the collector of Q4. C13-C15 and L1-L2 form a low-pass filter to attenuate harmonics of the 10-meter output.

Receive Mixer

The incoming 10-meter signal is first low-pass-filtered by C13-C15 and L1-L2, which attenuates unwanted signals above 30 MHz. C16 lightly couples the incoming signal from the low-pass filter to resonant circuit C17-L3. This type of coupling has a high-pass-filter characteristic, which helps reject signals below 10 meters. CR4-CR5 clamp the rf voltage at gate 1 of Q5 during transmit to avoid damaging the transistor. Gate 2 of Q5 is driven from the local oscillator through C37. Drive level is about 4 V p-p. The drain of Q5 drives a double-tuned bandpass filter consisting of L4-C21 and L5-C22. The double-tuned filter attenuates local-oscillator feedthrough and other unwanted signals

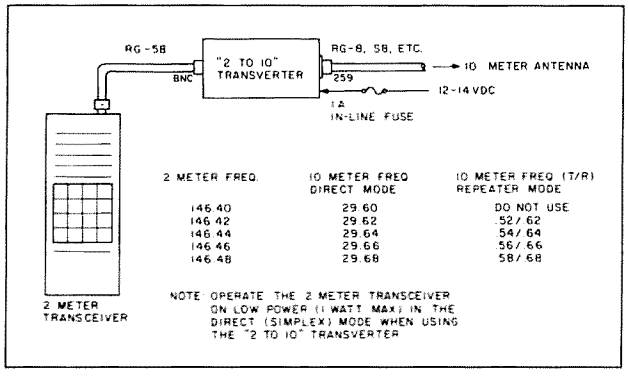


Fig. 1. 2 to 10 hookup.

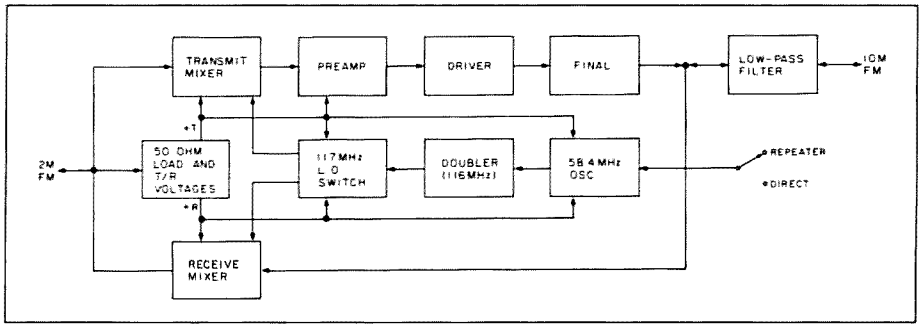
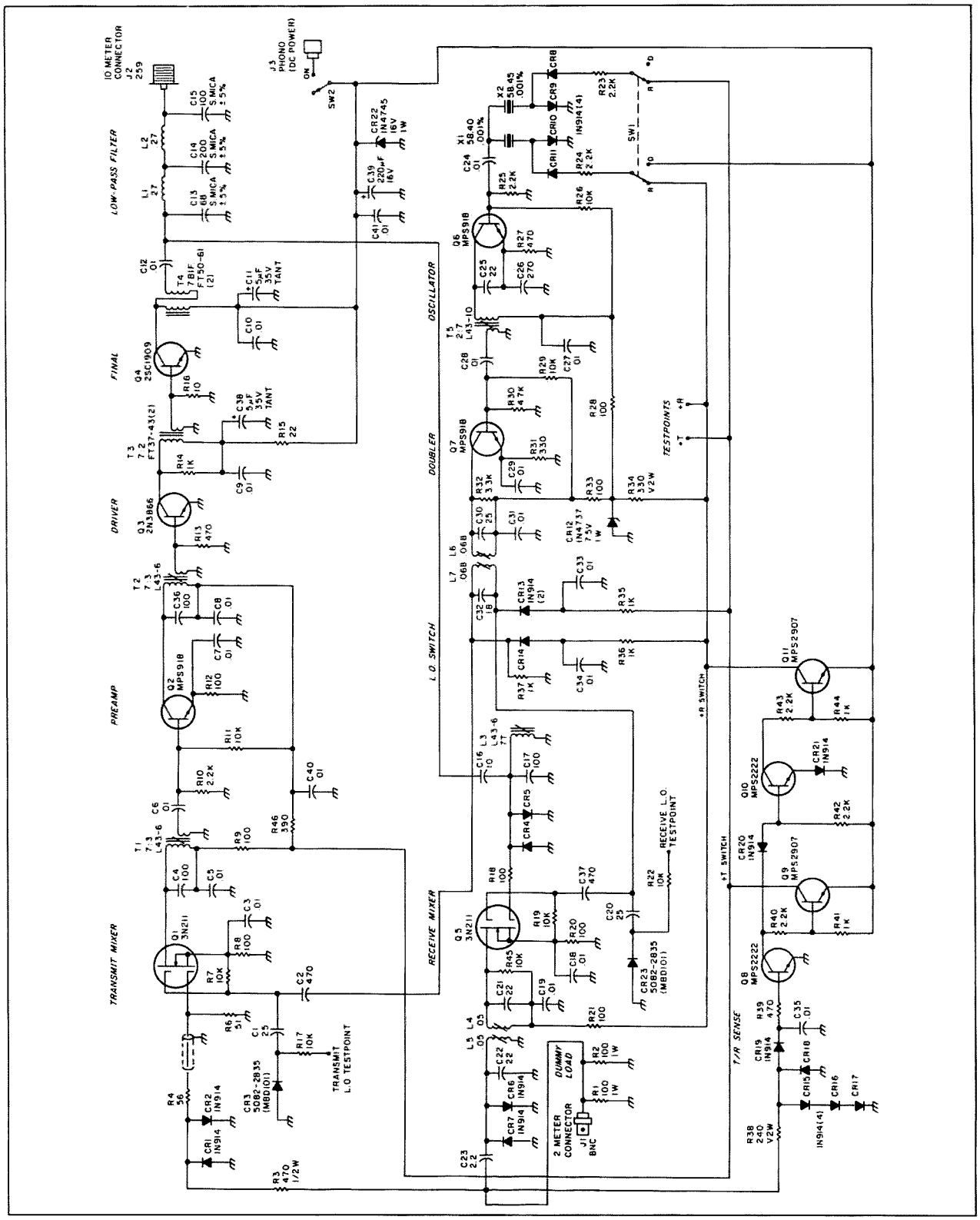


Fig. 2. Block diagram.



1. Unless otherwise marked: resistors are ±5% carbon film or carbon composition, 1/4 W; capacitance values greater than 1 are in pF, less than 1 are in uF; capacitance values between 1 and 82 are 500 V dc NPO ceramic, ±5%; capacitance values between 100 and 1800 are 500 V dc Y5P (temperature stable) ceramic, ±10%; capacitance values between .001 and .1 are 50 V dc Z4V (general purpose) ceramic, + 80, −20%.
2. Crystals are ±.001%, third overtone, series resonant, HC25/U holder.
3. See Fig. 8. for rf inductor and transformer data.

Fig. 3. Schematic.

in the mixer output before they reach the 2-meter receiver and cause intermodulation problems. C23 lightly couples the mixer output to the 2-meter connector. CR6-CR7 clamp the rf voltage fed back toward the drain of Q5 during transmit. The light coupling and clamp circuits on each side of Q5 allow 2 to 10 to switch from receive to transmit without needing isolation relays.

The conversion gain through the receive mixer is about 0 dBm, due mainly to the light coupling in and out. I wanted no conversion gain through the receive mixer to avoid overdriving the 2-meter receiver and creating intermodulation problems. I felt this was especially necessary for HTs, as they must often sacrifice "strong" front ends for low power drain and compactness. On-the-air testing with 2 to 10 using my ICOM IC-2AT has demonstrated satisfactory sensitivity and no evidence of intermodulation. A signal of −113 dBm (0.5 uV) at the 10-meter input of 2 to 10 will cleanly break the squelch of my 2AT.

Local-Oscillator Chain

Q6 operates as a grounded-base 58.4-MHz Colpitts oscillator. The ground path for the base of Q6 is through the series resonance (3rd overtone) of the crystal selected to control the oscillator. Adjusting the slug in T5 allows a slight frequency adjustment of the oscillator for "netting" it on frequency. CR9 and CR10 operate as current-controlled switches that select either crystal X1 (58.40 MHz) or X2 (58.45 MHz). When switch SW1 is in the direct mode, X1 is selected to control the oscillator in both transmit and receive. When SW1 is switched to the repeater mode, X1 is selected for receive by the +R voltage and X2 is selected for transmit by the +T voltage (providing the needed transmit offset).

The output of the 58.4-MHz oscillator is doubled by the Q7 stage. The collector of Q7 drives a double-tuned 117-MHz filter consisting of C30-L6 and C32-L7, which attenuates the 58.4-MHz fundamental and the unwanted oscillator harmonics. This is necessary to suppress unwanted responses in the mixers.

CR13 and CR14 are used as current-controlled switches to route the 117-MHz local-oscillator output to the transmit or receive mixer. In transmit, CR13 conducts, rf grounding the receive-mixer side of C32-L7 through bypass capacitor C33. Local-oscillator voltage is then routed from the ungrounded side of C32-L7 to Q1. During receive, CR14 conducts, rf grounding the transmit-mixer side of C32-L7 through C34. Local-oscillator voltage from the receive side of C32-L7 is now supplied to Q5. C20-CR23-R22 provide a dc sample of the receive-mixer local-oscillator voltage for tune-up and testing. C1-CR3-R17 provide the same function for the transmit-mixer local-oscillator voltage.

Components

As I mentioned earlier, the components used in 2 to 10 are readily available. Fig. 4 provides a listing of mail-order distributors for the components in 2 to 10. I recommend that you avoid substitutions. One exception would be C23. You can use a 2-pF silver-mica capacitor if you have difficulty finding a 2.2-pF NPO ceramic capacitor.

Construction

Above 100 MHz, the circuit board itself becomes an important component. For this reason, I strongly recommend that you duplicate the circuit-board layout shown in Fig. 5. Fig. 6 provides recommended hole sizes and corresponding number drills. Use .062"-thick G-10 glass-epoxy circuit board with 1-oz. copper on one side. Be sure to fully etch the board and inspect it carefully before beginning construction.

Rf Inductors and Transformers

I recommend winding all transformers and inductors before you start to load the circuit board. The winding data is provided in Fig. 8. All air-core inductors are wound on screw mandrels. You can pick up a set of screws (2- to 3-inch lengths) at your local hardware store. Radio Shack markets a packet of magnet wire (278-1345) which includes one roll each of 22, 24, and 30 gauge. The enamel on this wire can be stripped with hot solder, so it is ideal for rf-coil and transformer winding. Notice that T4 is bifilarly wound. I used a variable-speed electric drill (go slow!) to twist a pair of wires to about 5-6 turns per inch. Epoxy the two stacked cores used in T3 and T4 together before winding. Use an ohmmeter to identify each winding of T4 at both ends. I painted a small dab of black enamel on each end of the primary winding for later identification.

All slug-tuned transformers and inductors are wound on L43-style Micrometals forms. The primaries of these transformers and inductors are close-wound single-layer solenoids. They are wound at the bottom of the form. Secondary windings are also single-layer solenoids, wound over the primary windings at the bottom of the form. Note that there are 3 pins on one side of the L43 form and 2 pins on the other. A primary winding will always have its leads terminate on the side with 2 pins; the leads of a secondary winding will terminate on the outer posts of the 3-pin side. The circuit board is keyed this way, so do it right.

All air-wound coils are made from 18-gauge bus wire. As mentioned, the mandrels make winding these coils a snap. Dimensions are also given in millimeters, in parentheses, if you are more familiar with the metric system.

Circuit-Board Loading

Fig. 7 details the component placements on the circuit board. Photo B will also help (slight changes have been made since the photo was taken—note that C13 is now a fixed-value capacitor). I prefer to first install the jumper wires and the coax between the 2-meter input area and Q1. Note that the coax is RG-58 with the outer insulating jacket removed. Watch diode polarity and transistor orientation carefully. Keep leads short. Be extra careful in installing T4. Note that it is hooked up as a step-up autotransformer. Install Q1 and Q5 in the circuit board after all other components have been installed. This will reduce the chance of damaging these static-sensitive parts.

Parts List

Component	Supplier #
Crystals	2
MPS transistors	3,4
2SC1909	6
3N211	5
5082-2835 (MBD101)	3,6
NPO ceramic capacitors	4
Y5P ceramic capacitors	4
Silver-mica capacitors	3,5
Other capacitors	3,4,6
Resistors	3,4,6
1N914	3,4,6
FT37-43 and FT50-61 toroids	1
L43-6 and L43-10 coil forms	1
Connectors and switches	6
Bud CU-3009A minibox	5

Note: The above components are available from many suppliers in addition to those listed below.

Suppliers:

1. Amidon Associates, 12033 Otsego Street, N. Hollywood CA 91607, (213)-760-4429.
2. Jan Crystals, 2400 Crystal Drive, Fort Myers FL 33906, (813)-936-2397.
3. KCS Electronics Corporation, Box 33205, Phoenix AZ 85067, (602)-274-2885.
4. Digi-Key Corp., Box 677, Thief River Falls MN 56701, (800)-346-5144.
5. Allied Electronics, 401 E. 8th Street, Fort Worth TX 76102, (817)-336-5401.
6. Radio Shack.

Fig. 4.

All circuit-board components are installed through the top of the board except R23, which is tack-soldered across L6 on the bottom (solder side) of the board. Note that resistors R17 and R22 are standing up as test points. Make a small loop in the top lead of these resistors. Note the ground reference points next to these resistors. Make small bus-wire loops for these points. It is best to use 1k resistors as test points for the +R and +T voltages. This will avoid a catastrophe if the test points are shorted together.

Make the hook-up wire leads going to and from the circuit board to SW1 about 6 inches long. Install one end of a 4-inch length of RG-58 at the 2-meter input/output point on the circuit board. Use a half loop of 22-gauge bus wire to both ground the coax shield and strain-relief it. Install a 13-inch length of RG-58 at the 10-meter input/output point of the circuit board. Be sure to ground and strain-relief this coax also.

Be sure to install a lightweight finned heat sink on Q4. Depending on the heat-sink design, you may need to clip one fin off the bottom of the heat sink to avoid mechanical

interference with C10 and C11. Secure T3 and T4 to the circuit board with RTV or Silastic compound if you are going to operate mobile.

After the circuit board is loaded, check carefully for solder bridges and cold solder joints. I found that shining a desk lamp through the component side of the circuit board helped in looking for solder bridges.

Enclosure

2 to 10's enclosure is made from a 6" wide by 3.5" high by 8" long aluminum minibox (Bud CU-3009A). Use the general layout shown in the photographs. I strongly recommend that you "key" the 2-meter connector by making it a BNC and use a 259 connector for 10 meters.

The circuit board is held in place with 4-40 screws, using 0.75"-long pieces of aluminum tubing slipped over each screw as spacers. The tubing has an inside diameter a little larger than 0.125 inches. Coordinate the mounting-hole locations of SW1 and SW2 with the length of the spacers to avoid mounting interference between the switches and the circuit board. Ditto on the connectors. Use bus wire to ground the coax shields at the connectors. Dress all wiring down one side of the chassis so that the circuit board can be stood up vertically for tune-up and testing.

Make a final careful check of the chassis wiring. Be sure all connectors and switches are tight.

Test Equipment

The equipment required to tune up 2 to 10 includes a 12–14-V-dc regulated power supply, a 2-meter transceiver, a sensitive 150-MHz counter, a FET multimeter or DVM, a sensitive swr meter and dummy load, a 29.6-MHz signal source, a tuning dowel, and a plastic tuning wand. Access to a good 30-MHz scope is desirable. A wide-range step attenuator(s) is also very useful. Refer to Fig. 9 for construction details of a suitable 29.6-MHz source and tuning dowel.

Coil Knifing

By now you may have noticed, and possibly with some concern, that there is not a single trimmer capacitor used in 2 to 10. This is deliberate. If you are going to use trimmer capacitors above 100 MHz, they must be good ones. Such trimmers are expensive and sometimes difficult to find. To avoid trimmer problems, I avoided using trimmers!

OK, how do we adjust those double-tuned circuits in the outputs of Q5 and Q7? We use a technique called knifing. Basically, we adjust the value of an inductor by stretching it out or compressing it. While it may sound crude, it is an excellent technique. Knifing is used extensively to adjust tuned circuits in TV tuners, broadcast radios, VHF/UHF ham equipment, etc. When done correctly it is both precise and stable. Best of all, it's inexpensive and easy to duplicate.

So much for the sales pitch. You need two tools for coil knifing—a tuning dowel and a stiff plastic tuning wand. A tuning dowel is a wooden (or plastic) stick with a ferrite slug on one end and an aluminum ring on the other. Bringing the ferrite-slug end of the dowel near the end of an air-core inductor will increase its inductance, whereas bringing the aluminum-ring end near the inductor will decrease its inductance. By monitoring a test point related to the tuning of the inductor, a decision as to how to adjust the dimensions of the inductor can be easily made by using the tuning dowel. You can think of the tuning dowel as a temporary inductor core.

Let's consider an example, the tuning of L6-C30 and L7-C32, the double-tuned collector load of Q7. The top end of R22 provides a dc test point for tuning (receive). Preset L6 by compressing it to a length of 0.20" (5 mm) and stretch L7 to a length of 0.25" (6.4 mm). With oscillator Q6 running, some dc voltage will be detected at R22 (0.5–2.25 V dc). We will tune for peak voltage.

Bring the ferrite-slug end of the dowel into the Q7 end (physical circuit-board layout) of L6. Note if the test-point voltage tends to rise or fall. If the voltage rises, compress L6 a bit and recheck the voltage. If the voltage decreased as the ferrite slug was brought near

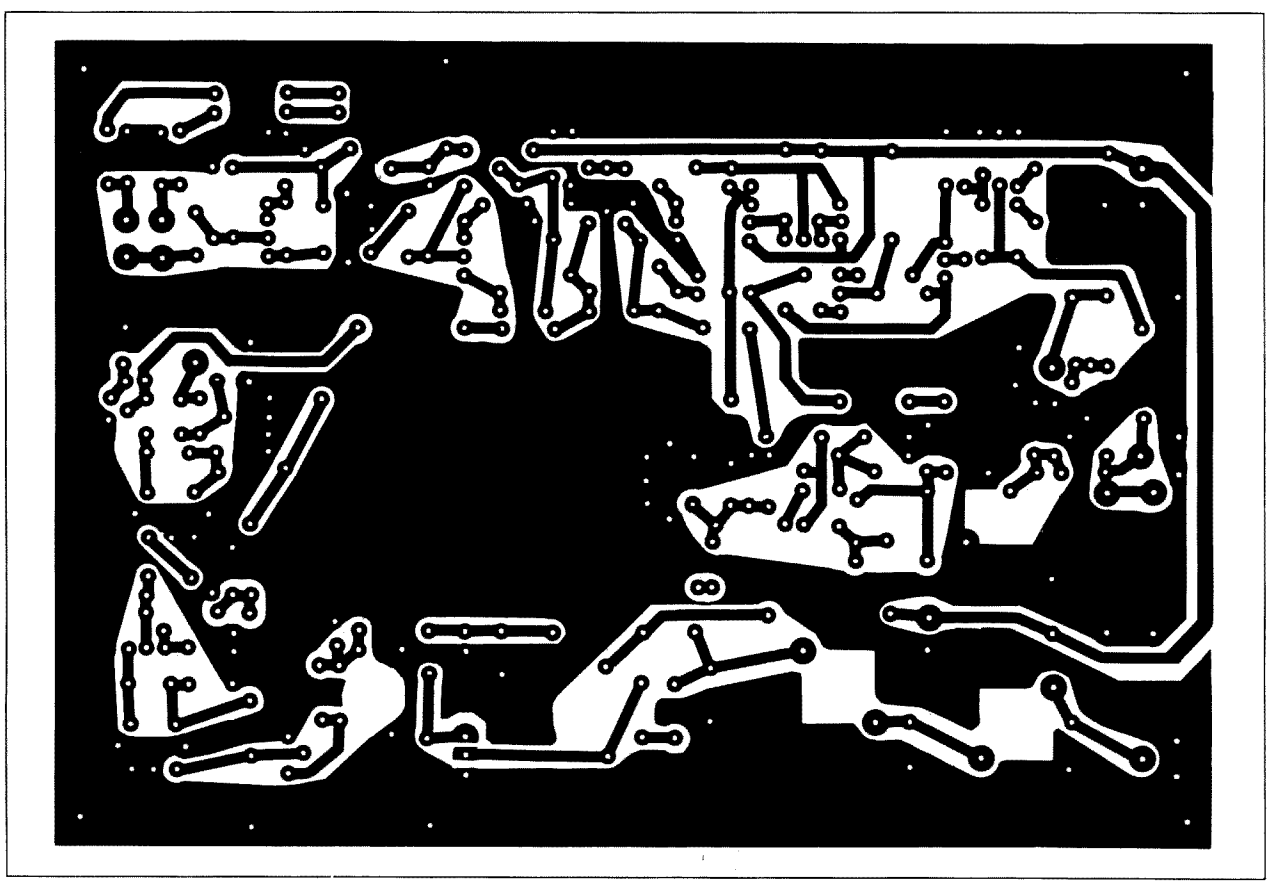


Fig. 5. Circuit-board artwork.

L6, try the aluminum-ring end. If the voltage rises, then stretch the coil a bit and recheck. When the coil is tuned on resonance, the test-point voltage will tend to decrease when either end of the dowel is brought near the end of the coil. After L6 is tuned, peak L7. The tuning of the two coils causes some interaction, so repeat the tuning process a couple of times. Once the coils are tuned closely, you can dispense with the tuning dowel and compress and expand the coils slightly with the plastic tuning wand (knife) while watching the test-point voltage. Push the coil far enough past the peak to take a physical "set" and let off. After about a minute of experience, you will be able to tune a coil by knifing about as fast as you could adjust a tuning slug or trimmer!

Tuning Setup

Hook up the regulated dc supply to the transverter, being sure to use a 1-Amp in-line fuse. Hook the 2-meter transceiver to the 2-meter connector of 2 to 10. Set the transceiver on low power (1 Watt maximum) and set it in the direct (simplex) mode. Tune to 146.400 MHz. Hook a dummy load to the 10-meter connector of 2 to 10 through a sensitive swr meter. Set the meter to read forward power.

T-R Voltage Check

Turn both the dc supply and 2 to 10 on. A lack of smoke at this point is a good sign. (You did get the polarity correct?) Check the +R test point. It should read within one volt of the dc supply voltage. The +T voltage should be off at this point. Bridge a 1k resistor between the supply voltage and the junction of CR19-C35-R39. Note that +T is now on and +R is off. Remove the 1k resistor.

Oscillator-Doubler Tune-Up

Back the tuning slug out of T5 so that it is about 0.20" (5 mm) above the top of the shield. Monitor the R22 test point. As the slug is slowly screwed in, the voltage at R22 should "jump" on, indicating oscillation. Bring the counter-sense loop near Q6. Adjust the slug for 58.400 MHz. Now tune L6 and L7 for a peak reading of at least 2 V dc (this corresponds to about 5 V p-p of rf) as discussed in the "Coil Knifing" section. Bring the counter-sense loop near L7. You should read 116.800 MHz. Fine-tune T5 as needed to obtain a 116.800-MHz reading at L7.

References	Diameter (drill)	Number
A	.035 (#65)	282
B	.040 (#60)	17
C	.052 (#55)	40
D	.082 (#45)	8
E	.125 (⅛")	4
		351

Material is green G-10 epoxy-glass, 0.062-inch nominal thickness, 1-oz. copper, single-sided. Reference hole A is unmarked.

Receive-Mixer Tune-Up

To adjust the receive mixer, a suitable 29.600-MHz source is needed. If you have access to a commercial signal generator with an adjustable output (down to 1 uV), use it. Otherwise use the source shown in Fig. 9. A step attenuator (or set of attenuators) with a 130-dB range is the best way to interface 2 to 10 with the source. If an attenuator is not available, leave 2 to 10 hooked to the dummy load and put a 2" bus-wire antenna into the BNC connector on the source. Move the source just close enough to the transverter so that the 2-meter receiver noise begins to quiet. (The bottom of 2 to 10's case is off for tuning.)

Remember, an increasing signal level quiets the background noise in an FM receiver. You adjust 2 to 10's receive mixer by tuning to "quiet" the noise output of the 2-meter receiver.

Start by compressing L4 to a length of 0.15" (3.8 mm) and stretching L5 to a length of 0.25" (6.4 mm). Back the slug in L3 out until it's about 0.05" (1.3 mm) above the top of L3's shield. You should be able to hear the 2-meter receiver quiet when you turn on your 29.600-MHz source. Start at 30 uV if you are using a signal generator, or switch in about 88 dB of attenuation if you are using the source in Fig. 9 with attenuators. Keep reducing (or increasing, if necessary) the signal level until some quieting is heard in the 2-meter receiv-

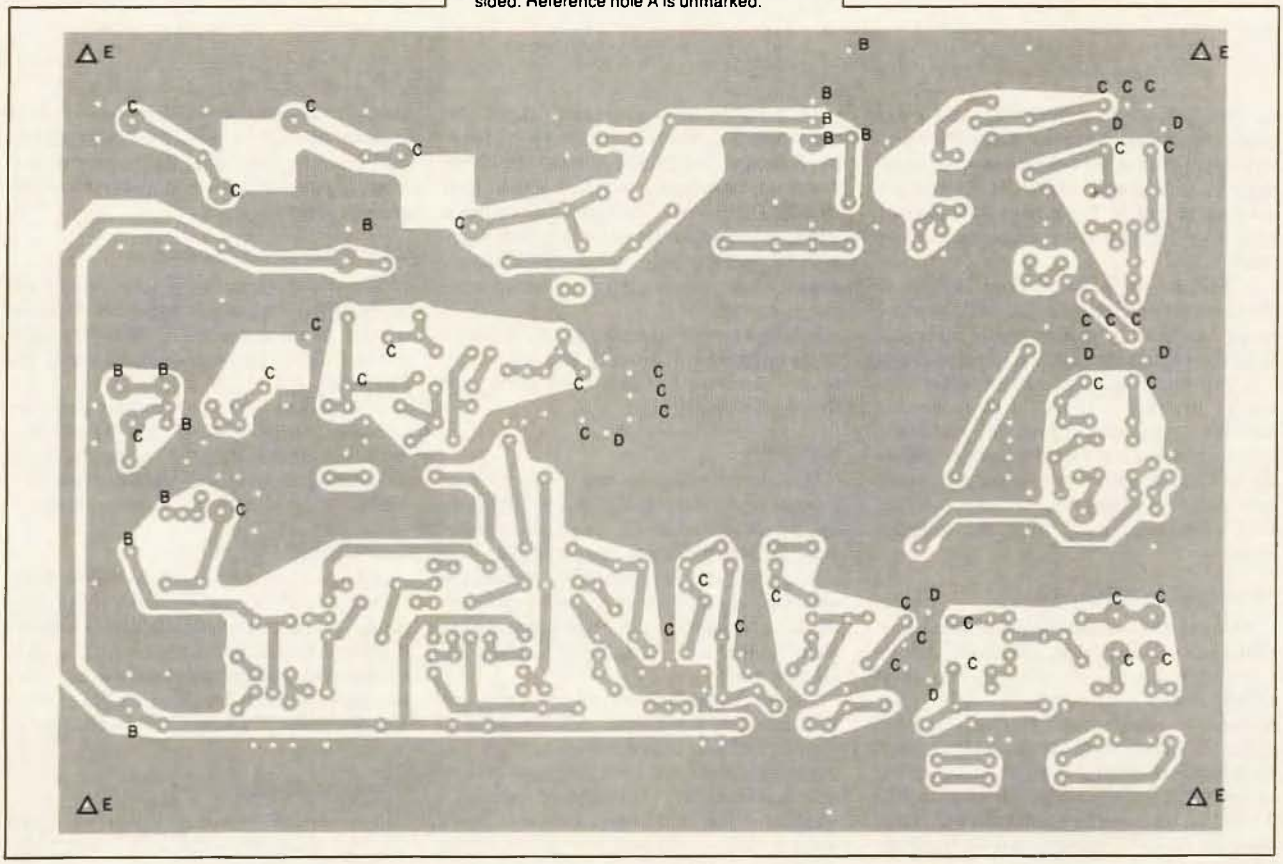


Fig. 6. Hole-size data.

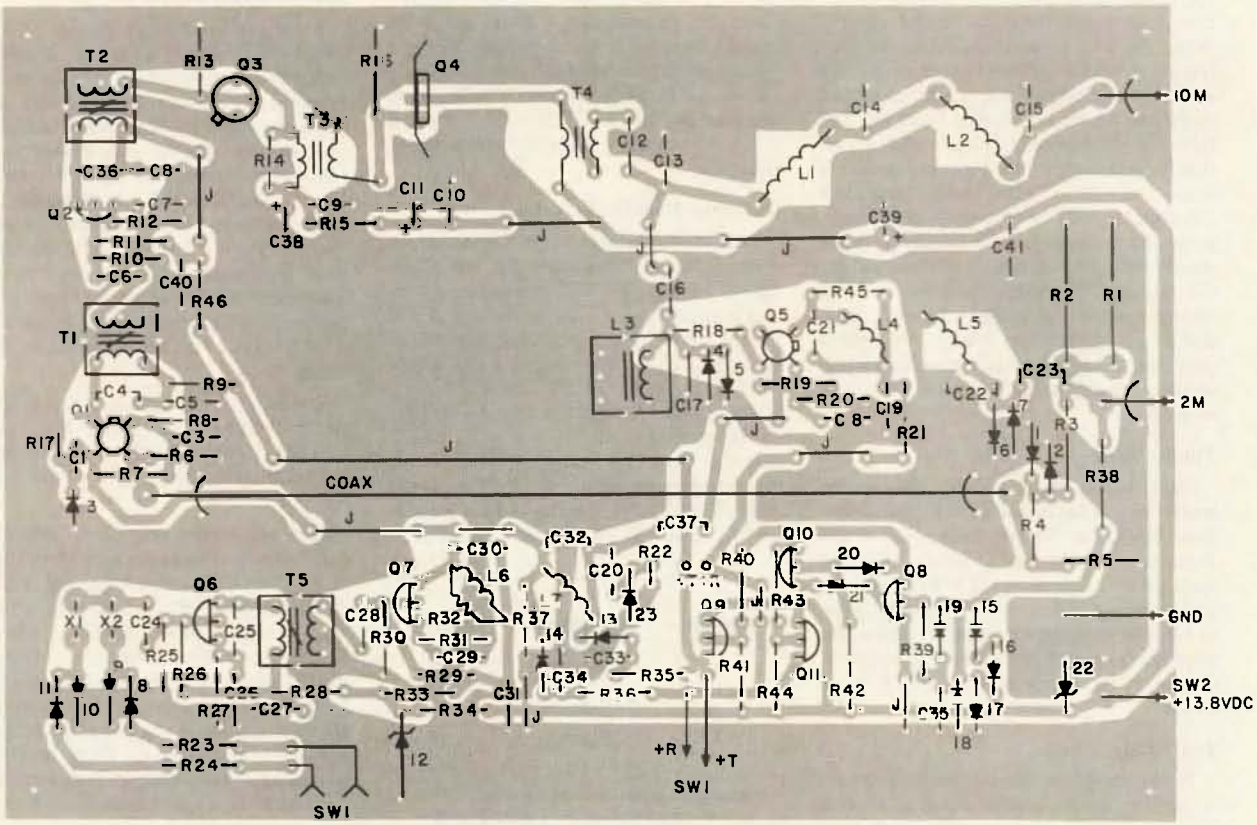


Fig. 7. Component placement.

er. Now adjust the tuning slug in L3 for greatest quieting. Keep reducing the input signal level as needed so that you have some noise to work against. Knife L4 for greatest quieting, then L5. These coils will interact some, so tune them in sequence several times.

If you are using the antenna instead of the attenuator with the 29.600-MHz source, simply move it to adjust signal strength. If you are using this method, I recommend that you touch up your receive-mixer tuning by hooking 2 to 10 to your 10-meter station antenna and by moving the source at least 30 feet from your transverter. Prune the antenna on the source (as needed) to reduce signal strength. I suggest that you do this final adjustment after tuning the transmit chain.

Transmit-Chain Tune-Up

Set 2 to 10 in the direct mode. While monitoring the +T test point, key down your 2-meter transceiver (on low power!). You should see +T switch high. With your transceiver keyed, confirm that you have about 1.5 V dc on the R17 test point. You will have some forward power showing on the swr meter. Carefully peak the tuning slugs in T1 and T2 for maximum output power. Then back the slug in T1 slightly out (counterclockwise) until the power just begins to decrease. Expect 3.5 Watts of output power. Key down your 2-meter transceiver and check the transverter's output frequency with the counter. It should read 29.600 ±.001 MHz. Now switch to the repeater mode. It should read 29.500 ±.001 MHz. Touch up the oscillator tuning so both readings fall within their tolerance. Notice that they tune up and down together. (You did use .001% tolerance crystals, didn't you?)

If things have worked out so far, welcome to 10-meter FM! If you run into any snags, review the theory of operation section for troubleshooting hints.

Operation

It is useful to tape a small card to your 2-meter rig (or the top of your 2 to 10) listing the 2-meter-to-10-meter frequency conversions for both direct and repeater modes. It is also a good idea to prominently include the note: *Operate the 2-meter rig on low power in the direct (simplex) mode when using the 10-meter transverter*. Remember: Garbage in, Garbage out!

2 to 10 draws about 50 mA in receive and less than 1 A in transmit. Always use a 1-Amp in-line fuse in the dc power lead going to the transverter. The 2SC1909 used in 2 to 10's final amplifier is reasonably forgiving of temporary load mismatches. However, don't abuse it. There is no reason to accept an swr greater than 1.3:1 since operation is quite narrowband. The lightweight heat sink used on the final is fine for the 1-minute-on, 1-2-minutes-off type of service that is typical of FM conversations. Beef up the heat sink if you are going to operate in transmit for long periods of time.

Direct/Repeater Operation

Most direct operation is found on 29.600 MHz. This frequency is monitored by many people, and a number of VHF/UHF repeaters have added crossband capabilities to this frequency.

The normal 10-meter repeater pairs are .52/.62, .54/.64, .56/.66, and .58/.68. Remember, *always* leave the 2-meter rig in the direct (simplex) mode. Use the DIR/RPT switch on the transverter to change modes!

Base-Station Operation

All you need is a regulated 12–14-V-dc, 1-A supply and a good vertical antenna. I am using a Cushcraft AR-10 with excellent results. Many people cut down CB ground planes with good success. As there is often a significant loss due to cross-polarization on 10 meters, it's best to use some type of vertical.

Mobile Operation

You can run 3–4 feet of coax between your 2-meter rig and 2 to 10, so mobile installation is fairly flexible. You will want comfortable access to the ON switch and the DIR/RPT

switch of the transverter. I prefer to take dc power from a point that disconnects automatically when the motor is cranked. This reduces the chance of damage due to an electrical transient. If you get a case of alternator whine, try a dc power filter such as the Radio Shack 270-050. 2 to 10 was not designed for operation at extreme temperatures. I suggest an operating temperature range of 40–100° F. On very cold or warm days, let 2 to 10's temperature normalize before operating.

Choosing a good antenna is the key to success for 10-meter mobile operation. If you already have a Hustler antenna, get the 10-meter resonator and use it. It's OK to trim down a CB antenna, but start with a good one! I am very skeptical of short antennas. I hope some of you antenna designers out there will work up a set of effective antennas for 10-meter mobile FM—maybe a good DDRR roof mount. Oh yes, avoid using crummy CB coax.

Coil Reference #	Nominal Inductance	# of Turns-N	Wire Gauge AWG.	Inside Coil Diameter D	Coil Length L	Spacing S	Mandrel
L1	.27 uH	6	#18 (1)	.45" (11.4)	.45" (11.4)	N/A	½-13
L2	.27 uH	6	#18 (1)	.45" (11.4)	.45" (11.4)	N/A	½-13
L4	+ .05 uH	3	#18 (1)	.22" (5.6)	.15" (3.8)	.2" (5.1):L5	¼-20
L5	– .05 uH	3	#18 (1)	.22" (5.6)	.25" (6.35)	see above	¼-20
L6	+ .068 uH	3	#18 (1)	.28" (7.1)	.20" (5.1)	.2" (5.1):L7	⅜-16
L7	– .068 uH	3	#18 (1)	.28" (7.1)	.25" (6.35)	see above	⅜-16

Parenthetical values are in millimeters.

L3 7 turns of #30 (.25) close-wound at the base of a Micrometals, Inc. L43-6 form, .40 uH.

T1,T2 Primary—7 turns of #30 (.25) close-wound at the base of a Micrometals, Inc. L43-6 form, .40uH; secondary—3 turns of #30 (.25) wound over primary.

T3 Primary—7 turns of #26 (.40) wound 75% around two stackedFT37-43 ferrite toroid cores; secondary—2 turns of #26 (.40) wound over the middle of the primary.

T4 7 bifilar turns of #26 (.40) wound 75% around two stacked FT50-61 ferrite toroid cores; interconnect for 1:4 step-up.

T5 Primary—7 turns of #30 (.25) close-wound at the base of a Micrometals Inc., L43-10 form, .34 uH; secondary—2 turns of #30 (.25) wound over primary.

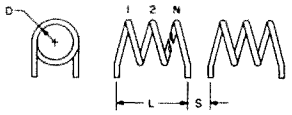


Fig. 8. Rf inductor and transformer data.

From Here

Ten has always been my favorite HF band because it provides local rag-chewing, surprising low-power DX contacts, and many operating modes. 10-meter FM ices the cake. I hope I have encouraged you to get on 10-meter FM some way. If you would like to write and ask a question about 2 to 10, please include an SASE. Please hold phone calls to Friday evenings, 7:30 to 10:30 p.m. Central time. No collect calls, please! See you on 10-meter FM. ■

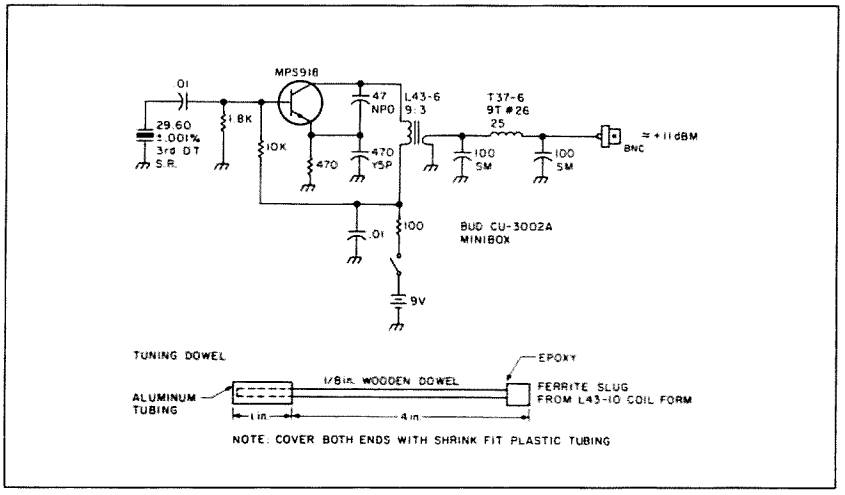


Fig. 9. 29.600-MHz alignment oscillator.

Reference

Dave Ingram, *10-Meter FM for the Radio Amateur*, Tab Publication 1189.

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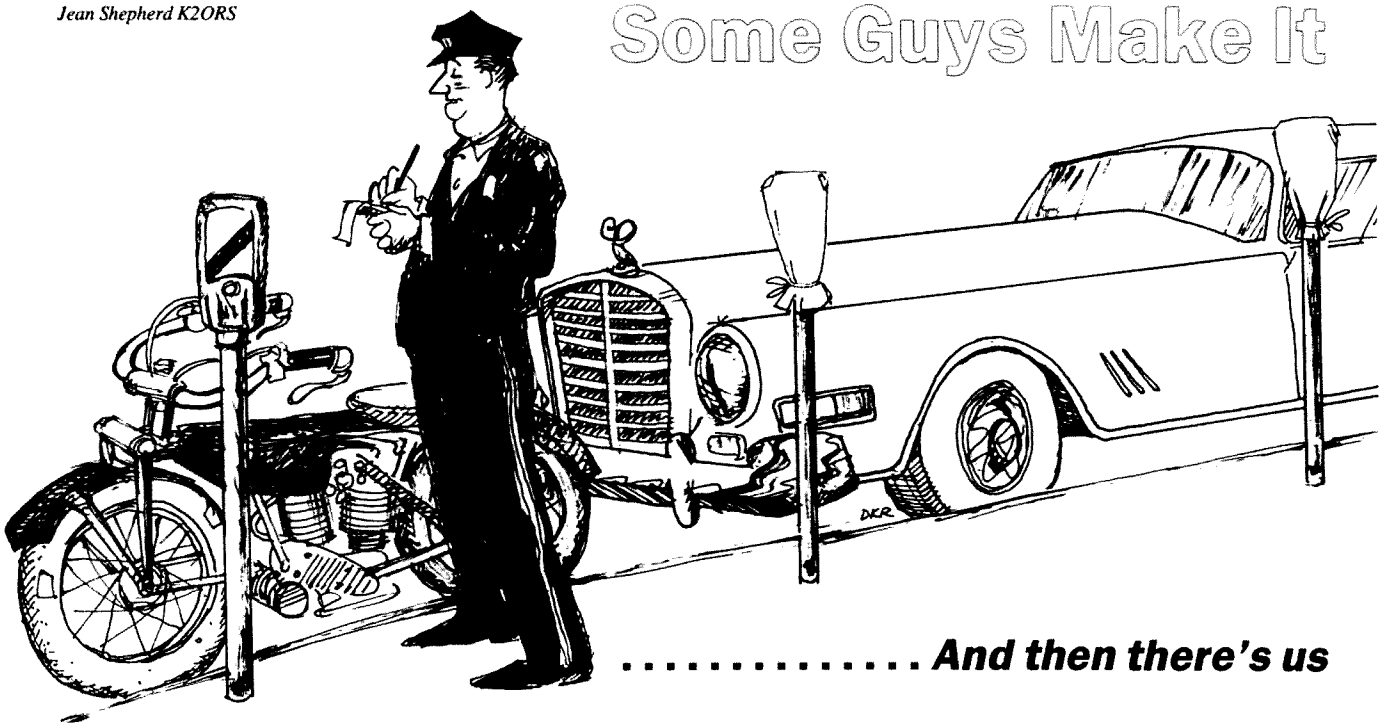
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Jean Shepherd K2ORS

Some Guys Make It



. . . . . And then there's us

While digging through a pile of vintage 73s the other day, we came across this gem by Jean Shepherd K2ORS. It originally appeared in the December, 1963, issue. Since it's already paid for and it's still as funny as the day we bought it, we thought you might like to see it again.—Eds.

You know, when you really step off a cliff, you know you've done it. It's just like looking out from the observation tower at the Empire State Building, and suddenly you're in midair and you know that there's no going back. I mean, it's a great flight, while it lasts.

It's maddening. You notice that up and down the street, the guys in the big Cadillacs never get tickets? Have you ever yet seen a ticket on a fat Mercedes? Let me tell you, I used to come back with my motor scooter decorated like a Christmas tree. You know, all those little green tags hanging like tinsel all over it. And in front of me would be a tagless Cadillac, and behind me a tagless Mercedes. Both parked there since last Easter. My scooter. . .I'd slow down, and the fuzz would be running alongside me, tying 'em on.

Well, that goes in all directions. There are guys who always get it you-know-where, and there are guys who don't. It's just that way. Now I don't know how it's set. I don't know whether it's predestination. I don't know whether it's preordained, but some guys from the very minute they're born—and they can be born in a rotten neighborhood—but from the very minute they're born, they are preordained or something to Make It. And there are other guys who are born to be Sunk. I mean just born to it. Your ship is leaking. From the very minute you start to walk. Your shoes squeak. And you're phonying it up, and hoking it up from the time you're six. Other guys *win* the sack races. You know, legitimately. They can run faster.

Well, let me tell you what happened one time. I'm on the air, you see. I'm a ham, and this is when I began to discover this principle. I'm a kid, and I got this paper route—rout. It was both a route and a rout. It's terrible to have to admit that even when I was a paperboy, I was a paperboy for a paper that was about to go out of business.

Every week you'd come around and you'd try to collect, and they'd tell you they want to drop the subscription, it's a rotten paper. It's awful. I had a paper called the *Herald-Examiner*. Did you ever hear of it, the *Chicago Herald-Examiner*? And you know it was such a bad paper that they didn't even read it in my house, and we had a free subscription.

"I am calling CQ from 9 o'clock at night till 4 o'clock the next morning. All I am raising is our light bill."

I used to go running around the neighborhood at four o'clock in the morning, delivering this rotten paper. It was a losing battle. And on Saturdays, every morning, I would go up and I'd knock on every third door, trying to collect the dough, and they'd say:

"Here's forty cents for last week. Please don't deliver the paper any more."

Well, then I'd have to go back and tell George The Paper Man that they quit down there, on Cleveland Street, those people down there, and he'd say:

"Ah, they're rotten people."

George was fighting a losing battle, too, because he had the *Herald-Examiner* franchise in the neighborhood and he was going down with the ship. And all these poor little kids who were 12 years old and who were getting knobby knees from running around with this paper, they were going down, too. Whereas right across the street from us there were a bunch of wiseguy kids who had the *Tribune*. And this big fat guy who had the franchise for the *Trib*. And they all got fat. All those kids are Republicans today. And Cub fans. All of the rest of us kids that had the *Herald-Examiner*, look at us. Ha! Democrats, following the White Sox till the day we die.

So anyway, I'm a kid and I get my ticket, and I figure I'm licensed, like all the rest of the guys. Except, of course, the Cadillac has the same kind of license on it that you've got, you know. It's the same piece of metal on the back, but Boy, what a difference.

So I get my ticket. I'm really gonna swing. I'm on 40 CW for about six or eight months, when I get on phone. Now I'll tell you what I was doing as far as phone is concerned. I figure I'm gonna try and make it in the big leagues. And I have a single 2A5. Final driven by a 56 tri-tet osc. Do you know anything about the 2A5? Well, it was a Pentode, a Power Pentode. Receiving type. I got ahold of this 2A5, and I was using a Majestic B Eliminator, which I had found in the basement of somebody's house, to power this thing. And it put out 135 volts. I can tell you exactly what I was running, it was 135 volts on the plate at 10 mils. So you can figure out what my input was. Into an RCA mismatched

receiving doublet SWL antenna. A special design they had to mismatch on everything. Didn't match anything. I could have done better with the bedsprings.

And so I've got this thing tuned up, and I'm running a cool 135 volts at 10 mils on the plate. I built a modulator. Oh, when I think of it. . .how sad.

The modulator was another 2A5, and I am grid-modulating the final. Well, you can realize the kind of output I have. I'm probably running about 7/10ths of a Watt, and you will never guess what band I'm running it on. I'm on 160 meters. Where a low-power guy was running 200 Watts and the high-power guys ran all the way up to, well, I would say WNBC standards.

I had this poor little receiver. I don't know whether you ever heard 160 meters when it really was wild. You know what you could do on 160? You could tune into the band, and when you hit the band it was one heterodyne from one end to the other. One *solid* heterodyne, without a break. And the heterodyne was of such a magnitude that your S-meter was on the pin all the way across the band. It never fell off.

So one night I'm on there. I throw my 7/10ths of a Watt right into the middle of it all. I have a very vocal special sound, the bored sound of a high-power man, calling CQ. Nonchalantly:

"Hello CQ, CQ 160. Hello CQ, hello CQ, hello CQ." Then there's a little silence while I'm tuning. [Sound of arc being drawn by pencil from final plate.]

"Hello. One Two Three. . .hello. Hello CQ, hello CQ, hello CQ."

Where you really sound like a big leaguer is when you turn the radio in the next room all the way up, so you sound like you've got so much power and so much gain, so much preamp gain that you can't cut down the background noise in your house. It sounds real great.

I've got the cans on. I'm wearing cans monitoring myself on my receiver. I am the only guy who can hear me, the only guy who could hear my signal.

"Hello CQ, hello CQ, hello CQ, hello CQ."

It's 9 o'clock at night, and everybody in the country is on. Believe me, that band was so insane and my rig so weak that with my signal on and my receiver on, I could hear the heterodynes through my carrier. If you know what I mean.

"Hello CQ, hello CQ, hello CQ, hello CQ 160, hello CQ."

I am calling CQ from 9 o'clock at night till 4 o'clock the next morning. All I am raising is our light bill. That's all that's happening. So the next night I come on again. I get on the air again, and it's great, you know, just to throw on all the switches. The one thing I had that was heartwarming was that my BH tube was leaky. I had a gassy BH. Did you ever hear of the BH cold-cathode rectifier? Well, it was leaky. It was gassy; it made a beautiful blue light like an 866 when I talked. Made me feel like I had real power.

"Hello CQ, hello CQ, hello CQ, hello CQ, hello CQ." And I'd see that blue light flickering. It was just great.

"Hello CQ, hello CQ, hello CQ, hello CQ."

Well, this goes on for one solid week. They can't even hear me in the next room. I haven't raised even a BCL.

"Hello CQ, hello CQ, hello CQ."

Finally Friday night comes along. And my friend Chuck down the street is W9AHS. He is running 6/10ths of a Watt on 20. He has not worked anybody on 20 since the preceding spring, when he worked a guy who was mobile and who drove right past his house. So the two of us are in the same leaky rowboat.

Chuck comes home from school, and he says:

"You're on 160, huh? How're you doing?" And I say:

"Ah, pretty good, Chuck. How are you doing on 20?" Twenty is a real Big League band. He says:

"Oh, not bad. Not bad."

We both made Class A, you see, but I didn't have the guts to go on 20 yet, because the band scared me.

Chuck says, "What do you say we work a little crossband tonight?" Chuck lived 10 blocks away from me. So I say:

"Okay, Chuck."

So Chuck has got his receiver tuned to 160 and I'm listening on 20 and sure enough, between all the heterodynes I hear Chuck come in:

"Hello, hello W9QWN, hello W9QWN, W9QWN. W9AHS calling W9QWN." So I throw on my transmitter. I'm on 160:

"Hello W9AHS, W9AHS." And Chuck comes back to me! Fantastic! He could hear me. Right in between all the heterodynes he says he could hear this little squeak, this little thing. He says:

"You're coming in. You're about an S2. About an S2. Readability is very low. About an R3, I'd say, about every 3rd or 4th syllable."

So, without thinking about it, we slip into crossband work, into duplex. And I leave my transmitter on, Chuck leaves his on, and I'm talking to Chuck. We worked crossband, *duplex*, for not more than 30 seconds.

Illegal.

And I'm talking to Chuck, Chuck's talking to me, back and forth. It was great. Finally:

"73, Chuck."

"Okay, Dad."

"Hello CQ, hello CQ, hello CQ, 160 phone—hello CQ, hello CQ."

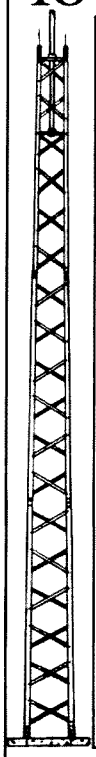
Six or eight weeks go by. When suddenly, in the mail, would you believe it? I get a card from the FCC. They got a listening station in San Diego. And they have ticketed me for crossband illegal operation. I am coming in there 599 XXXX. A ton of bricks! On 160!

Well, I figured, you know, there's some guys get ticketed and then there's others that don't. About that time I realized that there are born losers and there are born winners.

Oh well, it doesn't matter. It only gets worse. But the thing you got to keep saying to yourself is that it gets worse for everybody, simultaneously, all of the time. Maybe. ■

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Simplex Repeaters?

What are they? And why would you want to use one?

CES, Inc., and local radio amateurs in Winter Park, Florida, have been testing and evaluating a simplified version of the simplex equipment discussed in this article. The purpose of this article is to generate more discussion and ideas on this subject, and not to set down any absolute standard or definition for such a machine.

With the advent of low-cost digital storage for voice retransmission, a new product to serve special amateur needs has become feasible—the Digital Simplex Repeater. The concept is very simple: A base station serves as the repeater, monitoring a standard simplex frequency and storing the received audio transmissions. Whenever a transmission ends, the receiver's carrier-operated relay (COR) signal goes off and the station transmitter will send out the previously recorded message. In its most basic form, the repeater automatically retransmits every received message. While obviously not a great way to carry on rapid-fire rag-chews and nets, this is a simple way for a base station to greatly increase the range of any hand-held or mobile radio unit. By using only simplex operation, all of the costs and technical drawbacks of full-duplex operation are eliminated. There is no input desensitization and no extra signal losses due to a duplexer.

Adding one slight refinement to the system makes it more than just a calling and testing machine: Reset On New COR. What this feature does is reset the digital store-and-retransmit logic whenever a second transmission is detected within two seconds of the first. This allows two stations to carry on direct communication without the delay or interference of the repeater. However, between buildings or in some other "dead zone" the operator needs only to delay two seconds, and the lost or garbled direct message is repeated loud and clear. The first station knows immediately when it is reaching the limits of direct communication when it hears the retransmission. The two stations now have the option of continuing with the repeater's help, signing, or coordinating a switch to an available duplex machine.

When no direct-path signals can be heard between two stations using the repeater, care must be taken to alternate turns using the machine so that doubling—or worse yet, both stations pausing for the other—does not occur. Since this is a valid and very useful mode, it makes sense to limit the storage time to a short period to minimize the "is he replying?" time. Fifteen seconds seems to be the maximum wait tolerance for "A-Type" (impatient) personalities. Fifteen seconds is actually quite a bit of time to relay information and ideas. The repeater, therefore, will only repeat the first 15 seconds of the last transmission. This may seem harsh to those who find two- or three-minute timeouts too fast on duplex machines, but it can be adjusted; it may even improve your operating habits. For a calling-frequency machine, 15 seconds is ideal.

Another possible feature of a simplex repeater is frequency sharing. This is possible when another refinement is added to the controller: Access Code Enable. Assume that the repeater can be activated by a single DTMF tone, such as "1." The tone should be required for two seconds to activate the repeater. This prevents voice "falsing" from inadvertently activating the repeater. Since for most applications the range of the repeater should not greatly exceed the range of the hand-helds or mobiles calling into it, most simplex repeaters should be modest—20 Watts to a 5/8-wave vertical, *not* a kW to a 200-foot-high yagi.

This modest (cellular-like) operation means that several simplex repeaters could be located on the same channel within overlapping areas, giving continuous coverage

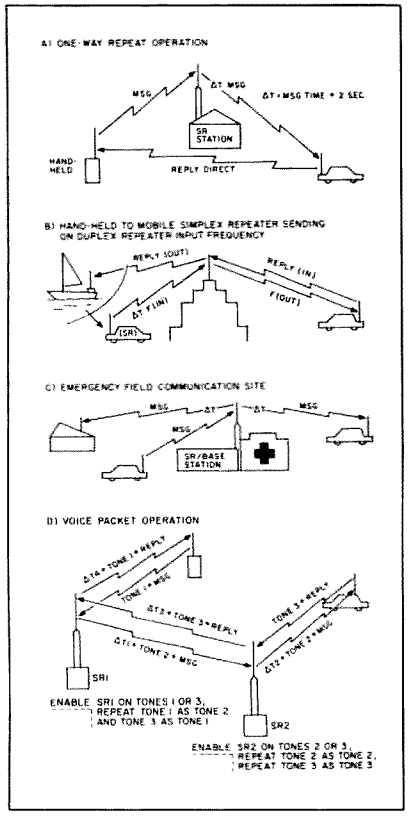


Fig. 1. Simplex repeater configurations.

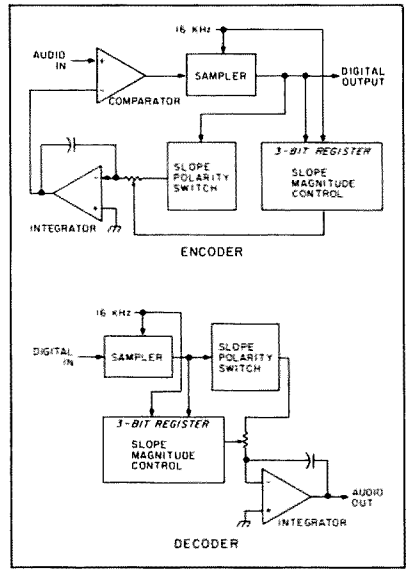


Fig. 2. CVSD encoder and decoder.

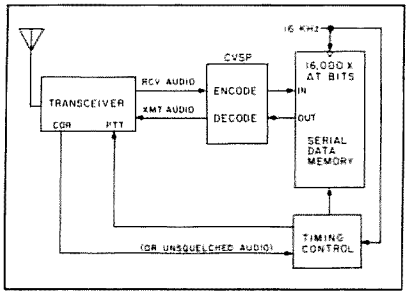


Fig. 3. Simplified block diagram for the simplex repeater.

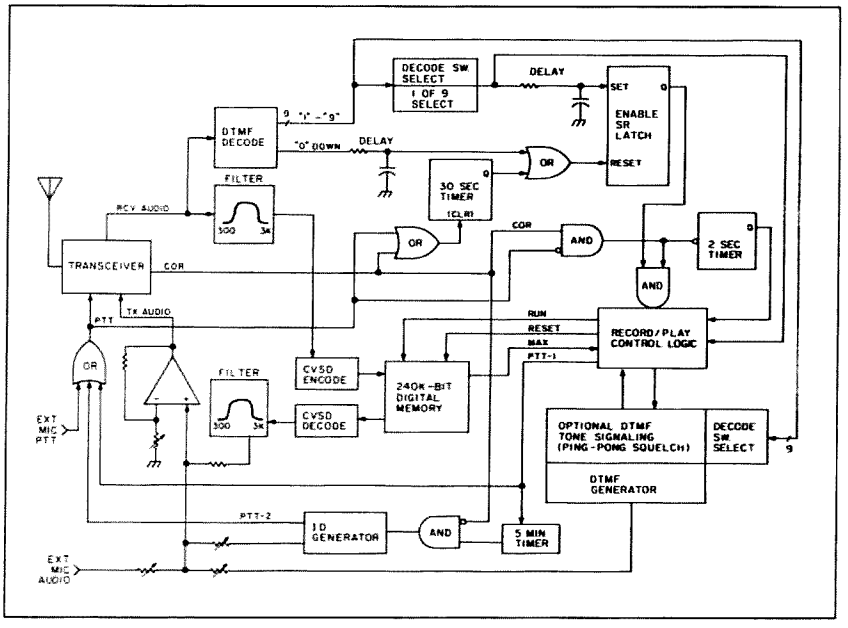


Fig. 4. Detailed block diagram for the simplex repeater.

throughout a major metropolitan area. If "1" and "2" are assigned to repeaters on the north end of the area, "3" and "4" to the east side of town, "5" and "6" to the south end, and "7" and "8" to the west, visitors would know which access code to try, depending on which part of town they were in. Multi-digit access codes could start with "9" and would be used for additional open, or private, repeaters. "0" would deactivate all repeaters within receiving range. With good planning and coordination, more than one repeater should be able to operate simultaneously without interfering with communications going through others.

The fact that one activation code automatically deactivates other machines within the listening range facilitates changing over to the best machine for your area of town. So, if you were using repeater 1 and then sent 2 at the beginning of the next transmission, repeater 1 would no longer repeat your message but repeater 2 would, if in range. This prevents two machines from repeating each other. This ping-pong mode would have occurred if machine 2 recognized its activation code and machine 1 were out of range by the time the changeover code was sent. If machine 2 sent a 0 tone burst as part of its initial ID message, machine 1 would still be deactivated and no ping-pong would occur. Having 0 as a universal deactivation code could be abused by pranksters, but it really is essential when skip conditions develop. Even the multi-digit activation stations should use 0 for deactivation.

As with any repeater, the ID should be automatically transmitted every five minutes (when in service) and must be readable through the repeated transmission. The operator should still identify at the beginning, end, and every ten minutes of the contact or test.

One very popular use of the repeater is for signal checks. It is easier to believe there is a problem if you can hear it yourself. Many DTMF decoder problems are really over- or under-deviation problems which can be readily fixed by just hearing your signal. Also, the simplex repeater is probably a more acceptable way to test for skip conditions—rather than tying up the local duplex machine (and two frequencies) just for a kerchunk and an ID.

Initial inquiries to the FCC indicate that no special authorization is required for the operation described. On 2 meters, repeaters and simplex are permitted between 146 and 148 MHz. So 146.40–146.58 and 147.42–147.57 (except for 146.52) are open for simplex repeaters (30-kHz splits are most common).

Another possible use of the simplex repeater is in your car, while you're out on a boat fishing (Fig. 1(b)). With a hand-held in the boat, you can hear your local repeater. However, without the repeater in the car, the hand-held is probably out of transmit range. If the hand-held starts making it on its own, a quick 0 takes the car "range extender" out of action. Note that the hand-held is in split mode, and the simplex repeater is set to the duplex repeater's input frequency.

For Field Day and for emergency field locations, the simplex repeater becomes a practical temporary-site repeater (Fig. 1(c)). The simplex repeater, whether temporary or part of a coordinated fixed system, could become a useful adjunct to amateur radio from 10 meters on down.

Simplex repeaters mean less congestion on the standard full-duplex channels and more effective direct simplex communications. With only a little imagination, you could set them up to relay messages in very much the same manner as packet radio does (Fig. 1(d)). Multi-digit DTMF tone enabling would most likely be used to signify the repeat paths for forwarding. You should probably consult the FCC before fully exploring this possibility.

The Circuit

The heart of the simplex repeater is the voice-to-digital (encoder) and digital-to-voice (decoder) converter circuit. The simplest way to digitize a voice is to store a digital image of the change of the voice signal, rather than store the digital value of the voice amplitude itself. The name for this type of converter is a Continuously Variable Slope Delta (CVSD) modulator/demodulator. This entire encoder/decoder function is available as a single 16-pin IC which operates on +12 V dc. Since only the change information is stored, the amount of memory required is less than that required by older analog-to-digital conversion techniques.

As with any sampled signal, the sample rate (bit rate) should be at least twice the rate of the highest frequency to be reproduced—this is called the Nyquist rate. The Nyquist rate implies that an 8-kHz sample rate should be sufficient for male voices in the 300–3000-Hz range. The ability of the CVSD encoder/decoder to handle amplitude variations (dynamic range) is enhanced by using higher sampling rates, making a sample rate in the order of 16 kHz more desirable than the minimal rate of 6 to 8 kHz. The total digital memory required for storage is simply the amount of timer storage time multiplied by the sample rate. Therefore, one 64K DRAM would store about four seconds of CVSD voice information, assuming a 16-kHz sample rate.

Fig. 2 shows a simplified diagram of the CVSD encoder and decoder. The encoder samples the difference between the voice signal input and the internal integrator which is being driven by the digital output to track the input signal. Each sampled output from the comparator drives the reference integrator either up or down in magnitude. This "louder/softer" bit is generated every 62.5 microseconds and is stored as one continuous bit stream.

A trick is employed by the CVSD manufacturers to allow an even wider dynamic range than that afforded by the 16-kHz sample rate. Motorola prefers to call this trick a "companding algorithm." The encoder and the decoder use the same algorithm so that the analog (voice) output is equivalent to the

The experimental system works on 146.4 MHz, using 17 Watts to a vertically polarized gain antenna at approximately 100 feet. The repeater operates under station call WA4HHZ. Here are a few of the comments from on-the-air users:

- Hilory K3VMG: "I get a lot of calls on the hand-held I can't answer direct. With the simplex repeater, I can answer back without running over to the main rig."
- Bob N4NDW: "The vehicular simplex repeater will be great for me as an outdoorsman. The possibilities are tremendous."
- Dave K7AFK: "Every club should have one as an on-the-air test machine."
- Jack WD4AWV: "It works fine, but what do you do with it?"
- Andy K4YKZ: "I like the built-in blooper reset feature—just release push-to-talk and start again."
- Al N4BUS: "I would much rather carry a hand-held than a radio in the car. Now my hand-held has the range of my home station."

original input. Companding consists of loading the last three bits from the encoder into a 3-bit shift register and digital comparator. If all three bits in the register are 1's, the reference integrator's output will be set to ramp up faster; if all three bits are 0's, the output will be set to decrease faster than if the two previous bits were not 0's. This simple fudge control over the integrator's gain increases the ability of the CVSD to respond to rapid changes in amplitude without increasing the overall memory requirements.

Fig. 3 shows a simplified block diagram of the simplex repeater. The only signals needed to control the system are COR from the radio and PTT to the radio. COR is the internal radio signal that disables the radio's squelch. Some transceivers provide this signal to a connector output, but the signal must be found from the schematic on most amateur radios. A few radios do not have a signal that is suitable for use by the repeater. For these radios, COR must be generated by an additional circuit that senses background noise on the unsquelched audio signal.

The receive signals to the repeater's CVSD decoder can be speaker audio or unsquelched audio. If the speaker audio is used, the volume setting cannot be changed once it is adjusted for the proper output deviation level for transmission. So, if the repeater is also to be used as a base control station, the audio to the repeater should come from the audio circuitry that precedes the volume control.

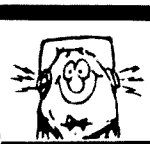
The PTT signal to the transmitter is activated to the radio two seconds after the COR goes off and remains off. The timing control must also ignore false COR inputs that normally occur immediately after PTT is released.

Fig. 4 shows a more detailed block diagram for a system that includes more bells and whistles. In addition to the basics shown in Fig. 3, the following seven functions are shown: (1) DTMF decoder for repeater activation/deactivation, (2) analog pre-filter and post-filter for CVSD, (3) auxiliary microphone input with gain control, (4) 2-second "wait for COR" timer, (5) 30-second deactivation timer, (6) 5-minute timer and ID generator, and (7) optional ping-pong squelch generator.

With the cost and complexity of the digital encoder/decoder and with memory no longer a major factor, the success of the simplex repeater depends on two important factors:

- Acceptance of the concept and constraints by the amateur community
- Technical improvements resulting in more sophisticated operation and reduced costs

Other factors that will weigh heavily on the spread of the simplex repeater are the FCC and ARRL. The "voice packet" concept is bound to be tried using simplex repeaters. This operation most likely will require regulatory sanction before it can grow. The basic one-repeater system, however, should be well within the limits of the current regulations. The challenge today is to try it, then improve it, and—some day—standardize it. ■



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Messing With Microwaves

Build a simple microwave transmitter and receiver for just pennies a MHz.

One area of electronics that seems to be sadly neglected by amateurs is microwave communication. This is due to the high cost of microwave components and the difficulties associated with microwave circuit construction. If this is what's holding you back from experimenting in this fascinating field, I think you'll enjoy this article on the construction of a simple microwave transmitter and receiver.

The transmitter and receiver described here are of such simple design that it is possible to build both in only a few hours and at a cost of less than $30. And since the design doesn't use exotic parts, you should be able to get all the components necessary to build both the receiver and the transmitter at Radio Shack.

First, let's begin with the transmitter since it's the more difficult of the two. Begin by getting a square piece of single-sided copper-clad PC board about 8 cm in diameter. In the center of this board, drill a hole large enough to accommodate a 1" 6-32 nylon screw. Before inserting this screw, take a small brass tube about 3.2 cm long and about 3 mm in diameter and solder it to the PC board—centering it just below the center hole (see Photo A). A good source for the brass tubing is a ball-point pen that uses the old brass ink cartridges. Once the brass tubing has been soldered to the PC board, you can insert the 1" 6-32 nylon screw in the center hole. This screw will be used to support the antenna once the components have been laid out on the PC board.

The next step in the construction of the transmitter is to drill another hole, in line with the first, 2 cm below the brass tubing. This hole will help form the variable capacitor which will be used to vary the frequency and power of the transmitter. A thin square piece of copper or brass, measuring ¼ cm along each side, is used to form the top plate of the capacitor. In the center of this small square, drill a hole that matches in size the hole drilled below the brass tube. Place a square piece of mica, somewhat larger than the square piece of brass, between the brass

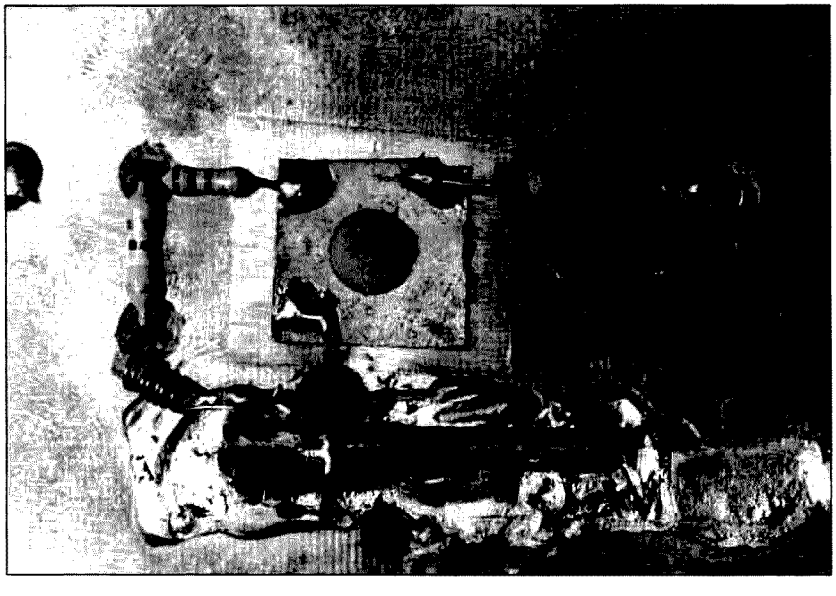


Photo A. The transmitter. The homemade capacitor is in the center, L1 is the long tube at the bottom and L2 is to the left of Q1.

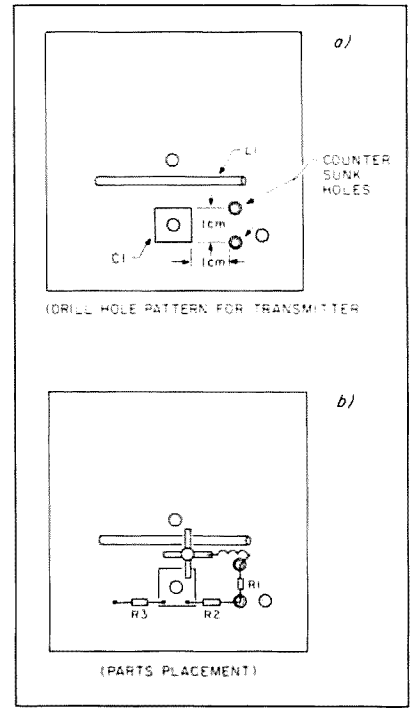


Fig. 1. (a) Drilling pattern for the transmitter board. (b) Parts placement.

square and the PC board. Transistor mounting kits sold in electronic supply houses are one source for the mica. A nylon screw is then inserted through the brass square, the mica, and the PC board. Complete the construction of the capacitor by attaching a nut to the screw on the back side of the board. By tightening or loosening the nut you'll be able to vary the capacitance on the homemade capacitor, and thus tune the transmitting frequency and vary the power.

After completing the variable capacitor, we must drill three more holes into the PC board to mount the four remaining parts. As you can see from Fig. 1, these holes are in line with two of the four edges of the variable capacitor. Two of these holes, 1 cm from the edge of the capacitor, must be drilled in a special way. Start by drilling two 1/32" holes 1 cm to the right of the right-edge corners of the capacitor (see Fig. 1a).

After these two holes are drilled, it will be necessary to countersink them by drilling in the same spot with a larger drill bit. With a ¼" bit, drill from about ¼ to ½ way through the PC board. The countersinking process is necessary for the removal of copper from around the holes, which prevents short-circuiting of the resistors to the ground plane. The third hole can be drilled anywhere along the bottom of the PC board, preferably close to the 1k-Ohm resistor.

Once the holes are drilled, the resistors are inserted as shown in Fig. 1b. On the right-hand lower corner of the capacitor, one lead of a 1k-Ohm resistor is soldered. The other end of the resistor is inserted through the hole immediately to the right. Directly to the left of this resistor (the lower-left corner of capacitor) a 4.7k-Ohm resistor is soldered to the top capacitor plate, with the other lead soldered to the PC board.

The final component, a 47-Ohm resistor, is installed in the two holes drilled that run parallel to the right hand side of the capacitor. After the leads of the resistor are inserted, you may at this time turn the board over and solder the leads of the 47- and 1k-Ohm resistors together. The other end of the 47-Ohm resistor is connected to a small inductor of your own making. It is formed by wrapping five turns of 30-gauge wire around a match stick. Once the wrapping is finished, slide it off the match and attach one end to the 47-Ohm resistor. The remaining end of the inductor is soldered to the emitter of the MRF 901 transistor (see Photo A). The base lead of the transistor is attached to the top plate of the capacitor, and the collector is attached to inductor L1 (the 3-cm-long tube).

The last bit of work involves soldering the power leads to the transmitter and installing an antenna. First, insert a red wire through the third hole, which we have not used as of yet, and solder it to the front of the PC board. Then take a black wire and solder it to the junction of the 47- and 1k-Ohm resistors.

This just about finishes the construction of the transmitter except for the antenna. The antenna is made by taking a thin strip of metal

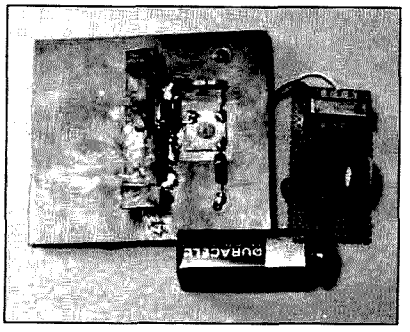


Photo B. With a power source, a modulator, and an antenna, the transmitter is ready to tune.

about 1 cm in diameter and 6 cm in length. At its center drill a hole to fit the nylon screw that formed the antenna mount described earlier. The height of the antenna should be adjusted (by the use of nuts) to a height of 1 cm above the ground plane for maximum signal transmission. For the antenna to function properly, it shouldn't touch any metal—such as the ground plane or inductor L1 (see Photo B). You may ask, how does the antenna work if it doesn't make contact with anything? It turns out that the microwave signal is transferred to the antenna by the inductive coupling with L1.

At this point our transmitter is fully functional and could be operated simply by applying power to it. However, I have found that many times it's more desirable to have the

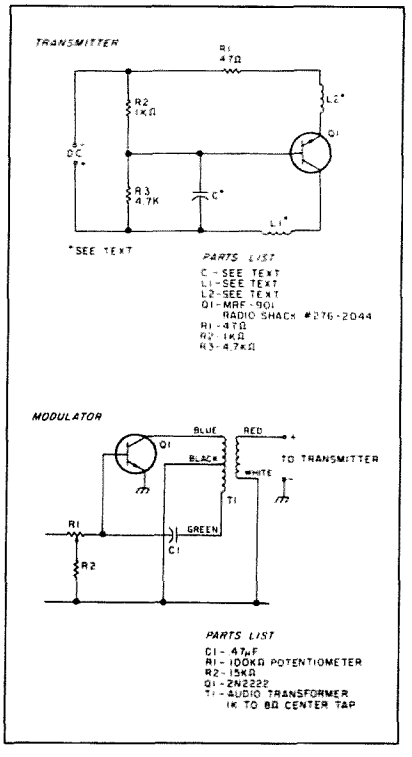


Fig. 2. Schematic diagram of the microwave transmitter and its companion modulator.

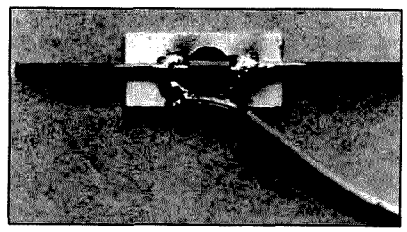


Photo C. The microwave receiver is a simple crystal detector.

transmitter modulated by the circuit shown in Fig. 2. This circuit is basically an oscillator that uses one side of an audio transformer as an inductor to provide the necessary feedback for oscillation to occur. To control the frequency of the oscillator you need only vary the resistance of potentiometer R2.

The Receiver

Once the modulator is constructed, the transmitter section of the project is finished. Now you are left with only the construction of the receiver. The receiver isn't far from the type built by most electronics enthusiasts at one time or another. It's the basic crystal radio receiver! The major difference is the length of the antenna and the type of diode used to detect the signal.

Start by finding the wavelength of the transmitter by using the following formula: $\lambda = v/f$, where f is the frequency in MHz, v is

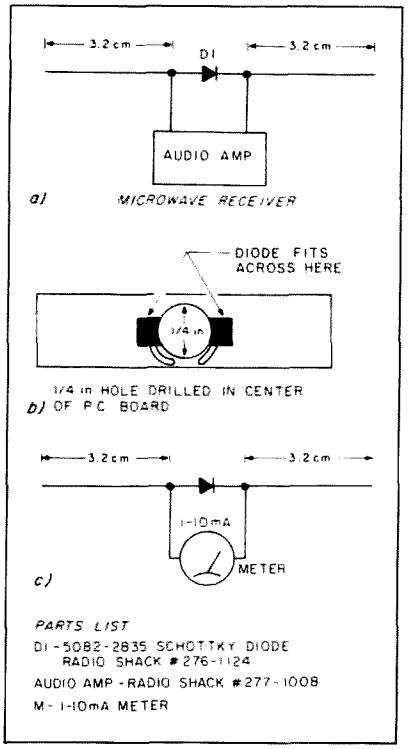


Fig. 3. (a) Schematic diagram of the microwave receiver. (b) Optional receiver PC board. (c) Using the receiver as a field-strength meter.

the speed of light in km/sec (300), and λ is the wavelength in meters. Using these values we find λ = 300/2400 = 0.125, or about 13 cm. For a dipole antenna, each leg should be ¼ of a wavelength long. So divide your answer by 4, giving you a value of 3.25 cm for each leg of the dipole. In truth, the antenna should be slightly shorter than this value due to end effects. However, since the transmitter can vary several MHz above and below the stated frequency of 2.4 GHz, this makes a good first guess.

To detect the signal generated by your microwave source, you must choose a diode capable of operating in the microwave spectrum. The diode that I use is the 5082 Schottky diode, available at most Radio Shack stores at relatively low cost. Other diodes designed for microwave use should work equally well, but as of this writing the only other diode I have tested is the 1N82A. This diode worked well, but it may be more difficult to obtain than the 5082. As can be seen from Fig. 3a and Photo C, construction of the receiver is trivial. Two stiff pieces of wire measuring 3.25 cm in length are attached to the ends of the diode to form the dipole antenna. A short piece of shielded cable is then connected across the diode, leading to an audio amplifier. In Fig. 3b, a PC board is shown for the receiver, if you wish to use it.

In Fig. 3c, the receiver is shown connected to a 1-mA meter for the purpose of peaking the transmitter output. This is done by first applying power to the transmitter and then placing the receiver at such a distance that the meter reads about half scale. The capacitor on the transmitter is then adjusted until the meter shows that maximum power is being transmitted. To truly maximize the power of the transmitter, it may be necessary to trim or lengthen the antenna, but in general the lengths given will work just fine.

Applications/Experiments

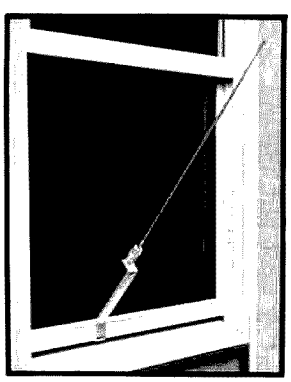
The first experiment is to measure the wavelength of the transmitter by a method called interferometry. Here we place the transmitter and receiver side by side, separated by a flat piece of metal to reduce interference with each other. A second piece of metal, somewhat larger, is placed a couple of meters away in front of the transmitter-receiver pair. This is done to cause the formation of a standing wave between the second reflector and the transmitter-receiver pair. To measure the wavelength of the transmitter a small third plate is inserted between plate number 2 and the transmitter-receiver pair. This third plate is then moved back and forth in between plate 2 and the transmitter-receiver. As this is done, a series of high and low tones will rush forth from the receiver. These tones, caused by constructive and destructive interference, will correspond to the nodes and antinodes of the standing wave. By simply measuring the distance that the plate is moved from one low tone to another, we can get a good estimate of the wavelength.

One possible use of the microwave transmitter-receiver came to me when I was performing the preceding experiment. As I was setting up the experiment, I noticed that as I walked around the room the same high/low tones were generated. It seems that standing waves are generated in the room as they bounce off the wall. As I walked around the room, some of the microwaves were bouncing off of me and causing the constructive/destructive interference needed to produce the high/low tones. But these tones were generated only when I walked about the room! So one possible use for the transmitter-receiver is for a very crude motion detector.

Another possible use is to construct a small radar system to measure the speed that objects are moving away from or toward you! Then, of course, there is always microwave communication to keep you busy. At this point, it's up to you to experiment and find uses for it.

One final word: The transmitter described here is one of low power output. However, its output *is* above the leakage level considered safe on microwave ovens. *Do not treat this as a toy!* It has great potential as a tool for learning about microwave radiation, but it should be respected at all times. ■

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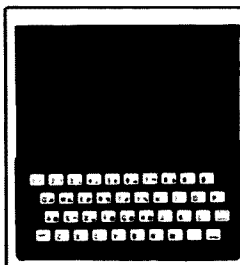
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They Threw What Away?

Your tax dollars at work: This time it's a UHF swr bridge.

I want to stress right at the beginning that this is intended to be a fairly serious article, not a sarcastic put-on of the "101 Uses for a Dead... (Transmitter, Computer, Battery, etc.)" variety. My intent is to alert the ham community to a particularly useful piece of military surplus gear and to suggest some innovative applications. Granted, not all of these are strictly limited to amateur radio, but then, most active amateurs have other hobbies as well.

First to the device itself. It's called a "Transmitter Performance Monitor R.F. Failure Alarm," and the model number is LDWS 00685 AD000. It consists of an aluminum rack-mount panel 1-3/4" high mounted to a 9-1/2" x 5-1/2" x 1-1/2" chassis with a cover plate. Inside, there are two small circuit boards; a dc alarm buzzer; three precision crystal-can relays; an assortment of pots, switches, and lamps; and the "Main Goodie" (see Photo A).

The Main Goodie is the reason I became interested in this item and purchased several at a surplus house near a big Air Force base in northern Michigan. It is a very high-quality UHF swr bridge with N series connectors mounted on the back wall of the chassis. The bridge is about 1" square and 4-1/2" long and is conservatively rated at 60 Watts @ 225–400 MHz, though I've used one on 2 meters with no problem (see Fig. 1).

The manufacturer's label identifies the Main Goodie as a Directional Power Indicator, model 3023 made by Coaxial Dynamics, Inc., of Cleveland, Ohio. From talking to one of the alarm manufacturer's employees at a hamfest and from the four-digit serial numbers on the ones I purchased, it's my guess that there are at least several thousand of these floating around out there in the surplus community, so keep your eyes peeled. The dealer from whom I got mine was selling them for the scrap price of the aluminum, about $1.40 a pound!

The original purpose of the device was to measure the carrier output of an Air Force UHF transmitter and to sound the alarm if the output to the antenna array fell below or rose above certain limits, preset by the pots on the front panel. Only the forward current side of the bridge was utilized; the reverse, or reflected, side was not connected. Hooking the bridge up to a 2-Watt Wilson 1402 HT on 2 meters generated about 1.5 mils on the 50-milliamp scale of my VOM for about 1-3/4 Watts of forward power at 146.52 MHz; reverse current as measured on the other terminal was negligible.

"The dealer from whom I got mine was selling them for the scrap price of aluminum, about $1.40 a pound!"

Besides giving a good relative F/R power indication for tuning and matching antennas and the like, another application immediately suggests itself to the ingenious amateur on a budget. Borrow somebody else's high quality precision UHF power meter, such as a Bird. Put it in series with the model 3023, a good resistive dummy load, and your UHF or VHF transmitter. Using either a surplus meter movement or the appropriate scale on your VOM, calibrate the model 3023 for a useful range of forward and reverse power levels. Then when you return the borrowed meter, as you eventually must, you will still have a highly accurate

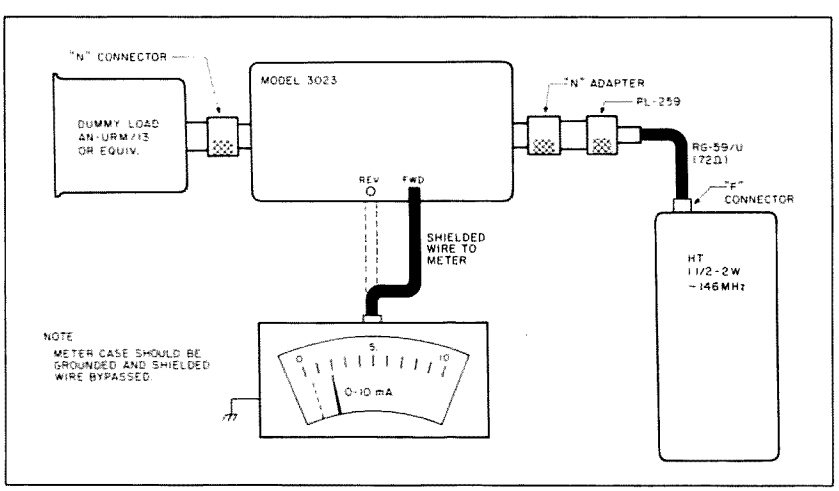


Fig. 1. Low-power 2-meter test setup.

power meter, adequate for most amateur purposes.

I have sold or traded several of these to other hams at hamfest flea markets. Most planned to use them as swr bridges or repeater monitors on 220 MHz. Besides the Main Goodie and its associated expensive silver-plated N connectors, several other parts in the assembly are worth scrounging. There are two very nice illuminated cartridge fuse holders, though you need to change the dropping resistor for the panel lamps if you use the fuse at some voltage other than 28 V dc. As is, the indicators are very dim when used at 12 V dc and *very* bright (but short-lived) at 110 V ac! There is also a matched pair of 2N3819s, common values of 5% resistors, etc.

Once you have salvaged the UHF bridge itself, there is one other small obstacle to be overcome before you put it directly into service. The current from the matched pair of diodes in the bridge is brought out to the alarm itself on a pair of miniature shielded coax connectors. Mating connectors for attaching your metering circuit are usually gold-plated and very expensive if purchased new. However, the same family of connectors is used in a lot of old avionics and other military surplus from the 1960s. I scrounged a few sets from some old Iranian terrain-following radar gear that a surplus dealer was going to melt down for the scrap gold. If you don't just happen to have an F-4 Phantom or similar jet fighter plane in your junk box, try the flea market at one of the big hamfests like Dayton or Orlando.

As a last resort, you can get out a small propane torch or a hefty (200-Watt+) soldering iron and carefully open up the cover of the silver-plated brass cavity of the bridge itself. It's perfectly possible to do this without destroying the diodes if you are careful. Once the plumbing is open, you can replace the connectors with insulated feedthroughs, RCA phono jacks, or some other more practical connectors. While you're at it, you might want to replace the N connectors with SO-239s or BNC fittings, though the N fittings are better. Adapters to UHF or BNC hardware are readily available in most surplus catalogs.

All right. Suppose you've got your hands on one of these and have pried out the UHF bridge for that new 220 FM repeater the local club is going to get on the air one of these days. You've carefully stripped the little circuit boards, and the miniature relays are going into the repeater controller. The 9-1/2" x 5-1/2" chassis will make a nice shielded enclosure for a home-brew direct-conversion or regenerative receiver for some Novice, maybe using the 2N3819s for the front end, if they're still good. That leaves the front panel, a 1-3/4" x 19" strip of 1/8" aluminum with some holes punched in it.

Before throwing the strip of aluminum away, or using it to beat the dog, reflect on the possible constructive applications. With the original chassis and shielded cover attached, the panel is almost a perfect fit for the standard 6-1/2" x 4-1/2" size circuit board with enough room left over in one end of the box for a hefty power supply. This size card is used by a number of different computer, video, and robotics companies and also fits several standard sizes of prototyping and perforated boards. It's hard to imagine a better way to mount a repeater controller, autopatch system, satellite antenna controller, etc. If you find that the 9-1/2" x 5-1/2" box is too small, almost any chassis up to about 17" wide can be installed on the panel utilizing the mounting holes already punched.



Photo A. The Main Goodie.

Even if you already have an excess of rack panel enclosures of all sizes, most amateurs can think of something to do with the panel itself with a little effort and ingenuity. A heavy strip of aluminum almost exactly a quarter wave long on 2 meters lends itself to all sorts of things, from a tuned line filter to a heavy-duty antenna element. Many times, I have been frustrated when I found that I needed a ruler or straightedge that was just a little longer than the standard 1-foot kind, but not so long and clumsy as the yardsticks that lumber yards give away. Scratching or etching metric or English measurements into a strip of aluminum like this takes only a few minutes and yields a very durable and versatile draftsman's aid.

If you have two strips like this, you can bolt them together by putting a countersunk flat-head machine screw through the central hole, the one originally intended for the alarm buzzer. This makes a great adjustable angle gauge for putting framing rafters on the new roof for a hamshack, tool shed, garage, etc. or for setting the angles when building antenna mounts, spiders for quad antennas, etc.

It has been my experience that 1-3/4" strip aluminum like this is very versatile, as it is soft and narrow enough for you to bend with pliers and a vise to make all sorts of brackets, mounting hardware, gamma match capacitors, and so forth. Heating the strip slightly with a propane torch to soften it before bending makes forming complex curved shapes like CRT mounting brackets and cable clamps even easier, though you should be very careful when doing this and take sensible safety precautions. ■

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Those Tantalizing Twos

ICOM's 2-meter HTs have a secret! For about a buck your IC-2AT will cover 145–155 MHz. Have an IC-02AT? It's really a 140–163-MHz scanner. And the audio can be boosted . . .

How would you like to have a VHF high-band receiver and a 2-meter handie-talkie all in one? If your answer is yes, do I have good news for you. ICOM makes it easy.

Several years ago I purchased an ICOM 2AT hand-held. Being a curious type, I had the schematic out and the back cover off almost before I got it out of the box (not recommended if you like the convenience of warranty service should anything go wrong). Upon closer examination, I discovered that the 2AT could be made to cover a portion of the 150-MHz spectrum. It's simple, and it's cheap—now *that* should appeal to a few people!

The Procedure

First, remove the battery pack. Then remove the four screws that hold the battery-retaining bracket and set it aside. Remove the two screws that retain the rear cover, and carefully separate the front and rear assemblies from the chassis. Carefully unplug the flex board going to the DTMF unit on the front cover. A small pick or screwdriver will make this easier to reach. Be careful not to break the small wires going to the speaker and the mike! Now remove the two Phillips-head screws on the side of the chassis nearest the PTT switch. The chassis will now open up like a book.

Refer to the schematic and the parts placement diagram in your manual; I have included sections of these in Fig. 1 in case you've lost yours. Notice that there are some unused pads on the circuit board going to pin 15 of the TC9122 PLL divider chip. This is the D1 pin, in ICOM nomenclature. If it is tied high (+5 V), the PLL will tune from 150 to 159.99 MHz. Another pad is ground. What you need to do is put a small bypass capacitor from pin 15 to ground, and a switch from pin 15 to the R5V line (receive +5 V since the object is to receive and not transmit). FCC rules prohibit the use of non-type-accepted gear for transmitting on these new frequencies.

"One of the combinations I hit upon allows the 02AT to initialize at 00.00 MHz and range to about 327 MHz."

Switching

Here's where your creativity comes into play. You may want to mount a switch differently than I did, so feel free to do so. Here's one way: Since I do not use a speaker-mike option with my radio, I borrowed the mike jack position to mount a switch (Photo A). First, disconnect and tape the wires going to the jack. Then remove it from the radio. In its place you can mount a small toggle switch. (You will see what I mean by small when you open the radio and see the cramped quarters!) I found mine at Radio Shack. Connect a small wire (wire-wrap wire will do) from one switch terminal to pin 15 of the PLL chip. Connect the other terminal to the R5V line. See Fig. 1 for details. Use a small, low-wattage iron.

There is one more wiring change if you have one of the earlier 2ATs. To enable all switch positions on the thumbwheel switch,

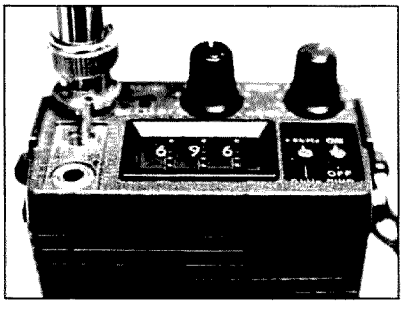


Photo A. Install the range switch in the microphone jack position.

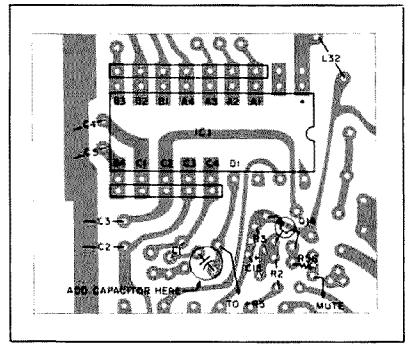


Fig. 1. Pulling pin 15 of the PLL divider chip high will cause the PLL to tune from 150 to 159.99 MHz.

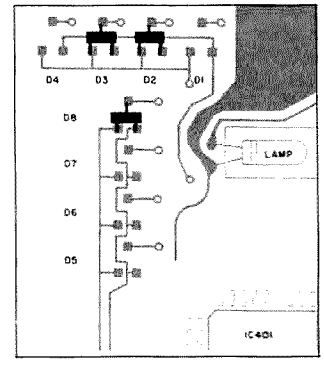


Fig. 2. Remove diodes D2 and D3 from the IC-02AT initialization matrix board.

do this: Find the flexible board running from the PLL divider to the thumbwheel switch. At the switch end, remove the jumper wire (see Photo B), and at the PLL end, bridge the gap in the trace at C4.

With the wiring done, you can close the chassis back up and replace the two Phillips screws. Replace the front cover. Don't forget to plug in the DTMF unit. Now temporarily replace the battery-retaining bracket using two of the four remaining screws. Install the battery pack. Now it's time to tune the PLL free-run frequency so the PLL will track over the new frequency range. Locate L3 in the vco can and, using a soft tuning tool, adjust for a voltage of about 0.75 volts at the lowest frequency desired at the test point. The proper resistor is identified by its lack of paint on the top lead.

The PLL will tune only over a 10-MHz range, so you can see that to get to 155 MHz you have to give up 144 MHz. This is not a problem in southeast Alaska since we have only one or two active frequencies, and all are at 146 MHz or above.

Receive sensitivity will be poor at the high end of the new frequency range but should be adequate for local listening. If you desire more sensitivity and have access to the proper test equipment, you can retune the receiver to favor the higher frequencies.

To use the modified ICOM 2AT, think of the switch as toggling between 140 and 150 MHz. Then just dial in the rest of the frequency as normal.

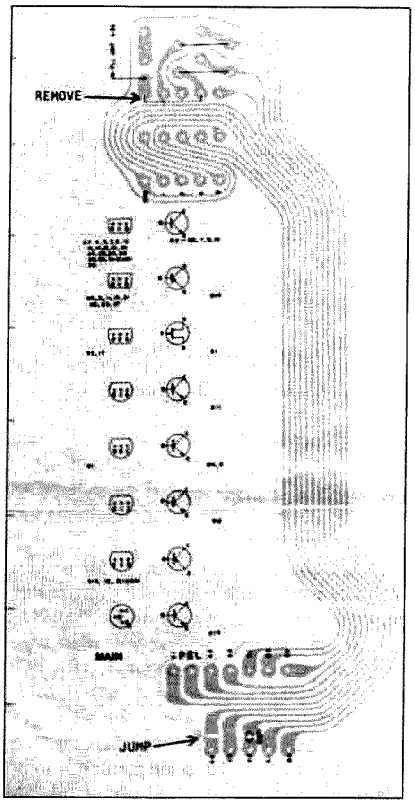


Photo B. If you have an early model of the 2AT, these two changes will enable all of the digits of the thumbwheel switch.

IC-02AT

As you can see, there are some limitations to this modification. After a year of using my modified 2AT I felt it was time to upgrade. Being partial to ICOM, I purchased the new 02AT. With the schematic in hand before the radio, I discovered that the microprocessor had an external initialization diode matrix. Aha, time to see what it would do!

After some experimenting, I discovered that I could make the microprocessor think it was an aircraft-band radio, a two-meter radio, a business-band radio, a 220-MHz radio, a 440-MHz radio, a 450-MHz business radio, a 1.2-GHz radio, and on it went. ICOM had designed a universal software program that would make the same processor work in all current and future products. Now remember, the actual radio is limited by tuned circuits to operation over a specific range of frequencies. Only the processor was being changed, not the radio. (Before you dig into your 02AT, check the serial number: It appears that rigs with numbers higher than 35,000 utilize different software. I'm working on a mod for these radios.)

One of the combinations I hit upon allows the 02AT to initialize at 00.00 MHz (dc) and range to about 327 MHz. In the middle of that range is two meters.

Changes to the initialization matrix cause the following to happen:

1. Direct frequency entry from 144 MHz to 165 MHz.
2. Offsets of up to 20 MHz.

The vco circuit will track over a 20-MHz range, but the bottom 4 MHz is not very linear, causing excessive deviation of the transmitted signal and a 1-kHz tone to appear on the audio. Deviation in the upper 5 MHz or so begins to fall off slowly with an increase in frequency, but that is of no matter since you won't be transmitting up there anyway.

How to Modify Your 02AT

1. Remove the battery pack, back cover, battery plate, and front cover, in that order. The front cover does not come free, but is attached with a ribbon cable to the main chassis.
2. In the front cover, locate the DTMF unit and remove the two screws holding it in place. Bend the metal tab of the matrix shield out of the way; then lay the DTMF unit over to the side.
3. Take out the three screws holding the matrix shield and remove it. These screws are tiny; don't lose them!
4. Using solder wick and a small flat-bladed soldering iron, remove diodes D2 and D3 (Fig. 2). Use an iron with a gounded tip since this circuitry is CMOS. Save the diode labeled with a "D."
5. Add three silicon diodes, 1N914, 1N4148, or equivalent, as shown in Fig. 3.
6. Solder the "D" diode you saved to the D5 position (Fig. 3) as shown in Fig. 1.
7. Replace the shield, taking care to look for solder bridges or short circuits.

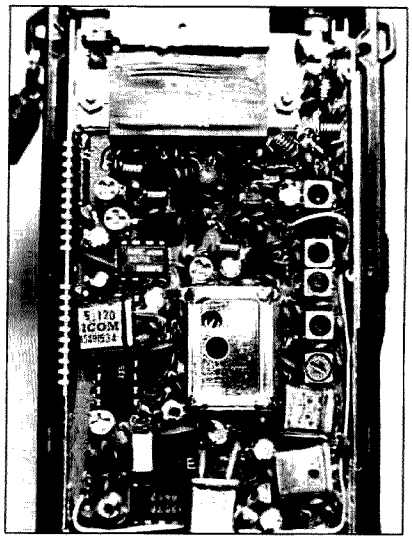


Photo C. L218, the vco frequency control, is located in the large silver box; the coil is under the lower hole.

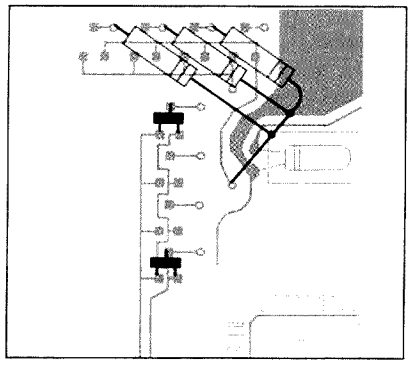


Fig. 3. Diode placement for steps 4–6.

8. Replace the DTMF unit.
9. Replace the front cover, the battery plate, and the battery pack. Leave the back cover off for now.
10. Turn on the radio and enter 140.00 MHz. Attach a dummy load to the BNC antenna jack. This is important as you will be testing out of the ham bands.
11. Key the transmitter using high power and adjust the vco free-run frequency so the display begins to flash. Adjust L218 (see Photo C). Usually the slug will have to be turned out of the can. Unkey and key the transmitter several times to refine the adjustment.
12. Enter 162.80 MHz and key the transmitter. The display should not blink (if it does it's not phase-locked).
13. Replace the back cover when you are satisfied with the range. If you wish to favor a different portion of the spectrum, just pick a frequency 4 MHz below the lowest frequency you normally will want to use and set the lower limit there. Total vco lock range is about 20 MHz on a typical 02AT. But remember that the bottom 4 MHz is nonlinear and not really suitable if you want a clean signal. If you are tempted to tune for a higher

range, and then expect to use the bottom end, beware the wrath of fellow hams, as you will over-deviate and splatter.

Receive sensitivity will be adequate above 155 MHz for local listening, but if you have access to a service monitor, this can be improved to better than 0.5 microvolts for 10-dB Sinad from 144 MHz to 161 MHz, and typically, 0.25 microvolts can be obtained over this range. I measured 0.15 uV for tight squelch at 145.00 MHz, and 0.60 uV for tight squelch at 162.00 MHz. I also noticed that transmit power was at the rated 5 Watts over this same range. This is, of course, only academic since you can legally transmit only in the ham bands with this radio, anyway.

More Audio

Now for a simple audio modification that will give an approximate 6-dB boost to the speaker volume. A quick check of the schematic will show that there is a 0.22-uF capacitor across the audio right after the detector. It is C117. While you have the front off the radio for the other mods, just snip this capacitor out of the circuit. See Photo D for the location.

Operation

There are a few things you will need to know about your radio after you make these modifications:

1. If you reset the processor by holding the function switch in while turning on the power, the display will initialize at 0.00. That's right, zero Hertz. To get up to the 100-MHz range, enter 9999; the display will show 99.99. Then use the up arrow to step to 100.000 MHz. Now you can enter the frequencies you desire.

2. You must now enter the 4 for tens of MHz, as well as the rest of the digits. Only the 1 (for 100 MHz) remains in the display.

3. When entering offsets, you must now enter all the digits. For example, for 600 kHz, enter 00.60. Offsets up to 20.00 MHz may be entered.

4. Any frequency from 140 MHz to 163 MHz may be entered into the memories to be scanned.

5. When entering a frequency outside of the ham bands, it is best to also enter an offset so that if you accidentally transmit, the frequency will fall in the ham bands.

There you have it. At least a dozen hams in this area have made these modifications to their ICOM 02ATs and all praise the mods and wonder how they did without. ■

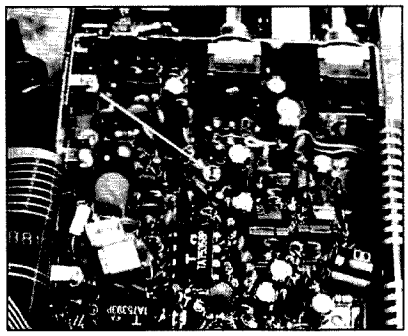


Photo D. Snipping C117 (see arrow) will boost the audio sent to the speaker.



Photo E. The fruit of your labor—an 02AT receiving weather broadcasts on 162.55 MHz.

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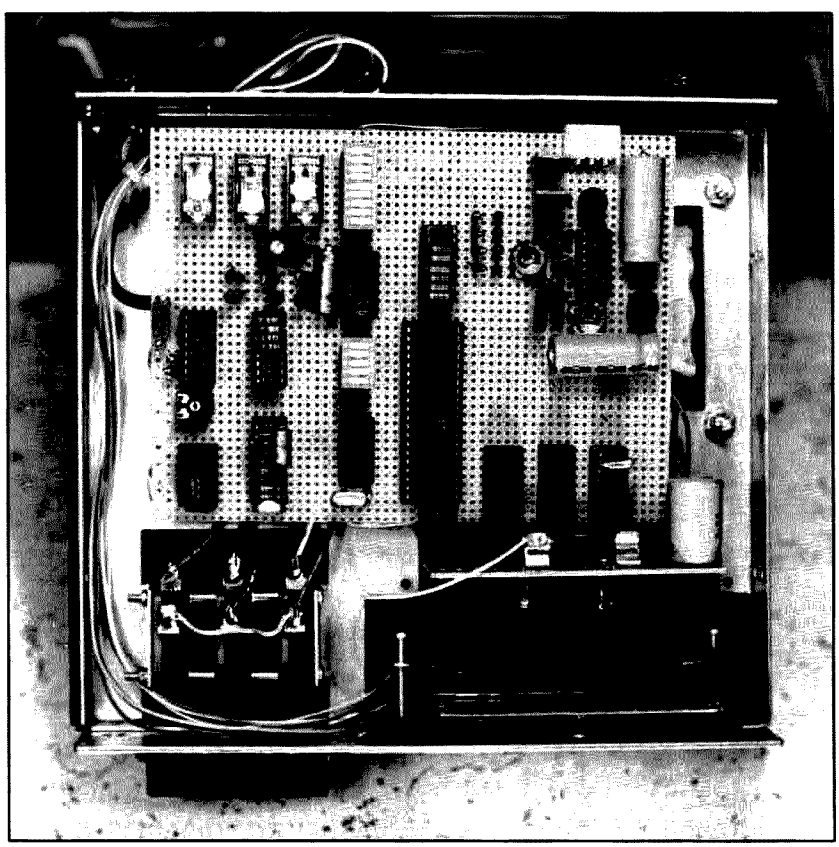
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Computer Rotor Control

The first step toward automating your shack.

Over the past few years, I have had the pleasure of spending many hours in the shack of a close friend who is a seasoned DXer. Watching him operate is always interesting, especially when an unusual call shows up on the band. Within the first minute after hearing the station, he has checked the log to see if he needs the contact, turned the antenna, and quite often established contact. Over the summer, he added a personal computer to the shack to help out with beam headings and the log. Not long thereafter, we got to discussing how great it would be if he could just type the DX station's call on the keyboard and have the computer rotate the antenna to the correct heading and display pertinent logging information. An interface between the computer and rotor control box was what we needed. An interface like this would also make satellite tracking easier and be a major step toward total computer control of the shack.



The rotor control board, tucked neatly inside, awaiting its next command.

I have constructed an interface which will allow any personal computer with a serial port to talk to the control box of a CDE antenna rotor, such as the CD-45, Ham IV, or Tailtwister. The computer need only output a single character representing the beam heading desired. The interface will then close the rotation contacts of the control box, bringing the rotor to the desired direction. The control box requires no modification, functions normally, and can be used instead of the computer to turn the antenna. Switching between operator and computer control of the rotor box is automatic, eliminating the need for the operator to do so. The circuit, an extension of K9AZG's "Automatic Beam Aimer" (*73*, November, 1982), uses 13 ICs and can be constructed by anyone with familiarity with digital circuits. I suggest reading K9AZG's article as it reviews the operation of the CDE control box.

Theory of Operation

The interface will begin to rotate the rotor as soon as a character is received from the computer. This character contains 8 data bits and can be calculated using a small subroutine or can be obtained from a lookup table.

As shown in Fig. 1, serial data is received by a Universal Asynchronous Receiver/Transmitter (UART) which converts the character to 8 parallel bits. Seven of the bits represent the desired beam heading and are transferred to the input of a digital-to-analog converter (D/A converter, or DAC).

The DAC generates a precise dc voltage specified by the digital input. This voltage represents what the control-box meter should read when the rotor is correctly aimed. This voltage is applied to one input of a comparator, with the other comparator input connected to the control-box meter. These two voltages are compared and an output voltage is generated which is equal to the voltage difference between the comparator inputs.

A negative output voltage indicates the rotor must be turned clockwise (CW). A positive output voltage indicates the rotor must be turned counterclockwise (CCW). Sensing the polarity of the voltage is accomplished using two comparators, one to sense negative polarity and one to sense positive polarity.

One comparator output drives the CW relay and the other drives the CCW relay. The contacts of these relays are in parallel across the rotation switches in the control box and therefore are able to turn the rotor. Brake release begins as soon as a character is received and ends shortly after the correct heading is reached in order to allow for rotor coasting.

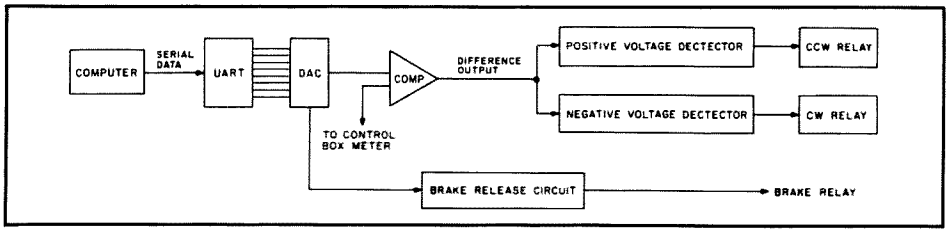


Fig. 1. Block diagram.

Construction

I have several suggestions which will save a great deal of time in building and testing this project. I strongly recommend that those building this project use wire-wrap construction. Point-to-point wiring is slow and messy, while design of a PC board requires a great deal of time. Wire-wrapping is fast, clean, and easy to learn. An electric wrap gun is cheap and will pay for itself within the first few hours of construction. Along with the gun, you will need an unwrap tool for correcting inevitable mistakes, as well as a special tool for stripping the wire.

The wire comes in different colors to make construction easy. Three small spools, each a different color, will be sufficient for this project. Use a different color wire for each stage and you will work faster with fewer mistakes. These items are available at Radio Shack and will become valued tools in the shack. [*I use an OK wrapping pencil available for about $30 from Jameco—it automatically strips the wire.* —Ed.]

Of equal importance is the construction technique. Since this circuit has several stages, I built and tested them one at a time. This way I knew exactly what worked as I went along. The most important benefit of this method is the opportunity for the reader to completely understand what each stage does. Other people's designs can be tough to get working without a logical approach. Build and test one stage at a time and you will be glad you did. In the following sections of this article, I have used this method so that testing can be performed as each stage is built.

Power Supplies

Four power-supply voltages are required, as shown in Fig. 2. The output of a 12.6-volt transformer is rectified and filtered to produce approximately +15 volts dc. This voltage is applied to the input of the positive voltage regulators and the relay coils. It's good practice to obtain relay drive voltage before the regulators since the relay coils present a heavy load in comparison to the logic and can produce transients on the supply lines.

+5- and +12-volt outputs are easily obtained using Texas Instruments regulators from Radio Shack. They should be heat-sunk to avoid thermal failure.

The +10-volt reference output supply may be obtained either of two ways. I used a 723 regulator and adjusted R2 to obtain 10 V. I had intended to use the less complicated LH0070 regulator, but none was to be found locally. If it's available, it will save some time and space; however, the 723 works equally well.

The −12-volt supply consists of a 12-volt transformer rectified and filtered to obtain approximately −15 volts for driving the negative regulator.

In order to test the supplies, disconnect the outputs from any loads and apply 120 V ac to the transformers. Feel the four regulators to be sure that they are not hot (warm is OK). Measure the unregulated voltage at the output of the bridge rectifiers. It should be at +15 or +20 V dc for the positive supply and −15 to −20 V dc for the negative supply.

Next, measure the +12-, +5-, and −12-volt regulator outputs. Finally, measure the output from the 723 regulator and adjust R1 for exactly +10-volts output from the regulator. Any supply output which is over the specified output probably has a wiring error or a bad IC. Any supply with a low output voltage should be checked to see if its output is being heavily loaded (it would also be very hot). Also check the input voltage to see if it's at least 2 volts greater than the rated output.

Serial-Data Port

I designed the serial-data input shown in Fig. 3 to be as flexible as possible for easy connection to various computers. Only two wires are required by the interface: receive data and ground. The serial-data input expects to see either EIA RS-232-level mark and space (−3 to −12 and +3 to +12 volts, respectively) or TTL-level input (0 volts and +5 volts). If an RS-232 interface is used, it may be necessary to make the interface look like a modem to the computer by connecting pins together on the DB-25 connector at the interface. This is accomplished by connecting pin 5 (clear to send), pin 6 (data set ready), and pin 8 (data carrier detect) to +12 volts. An alternate approach is to connect pin 4 to 5 and pin 6 to 20, as shown in Fig. 3. These jumpers are only required if the computer requires handshaking in order to output data.

RS-232-level data is converted to TTL-level (5 volts) data with an MC1489 line receiver and applied to the input of a UART. If the computer outputs TTL-level data rather than RS-232, it will be necessary to check whether the output data is inverted. In order to do this, measure the voltage at the computer's serial-data output. When no characters are being sent, the line should be in the mark state and be at +5 volts. When a character is being sent, the line should alternate between +5

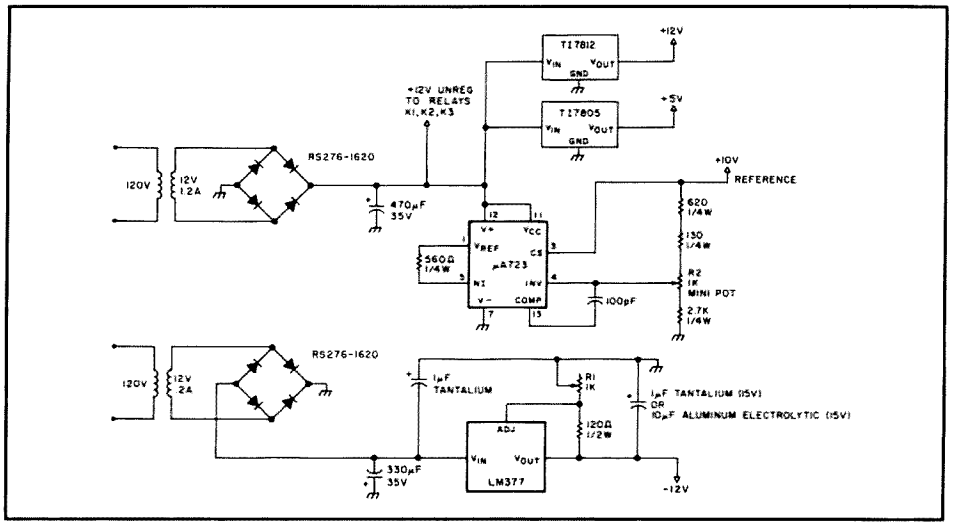


Fig. 2. Power supply.

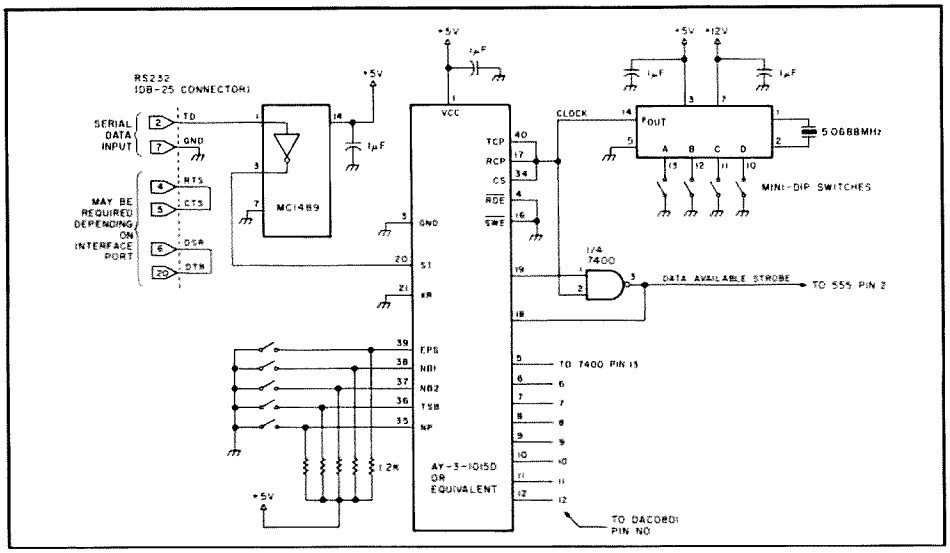


Fig. 3. Serial data input.

and 0 volts. If this is the case, disconnect the 1489 and apply the TTL-level data to the serial input of the UART. If the computer output is 0 volts when idle, apply TTL-level data to the input of the 1489.

The UART is a communications IC which receives, transmits, and buffers serial data. It is divided into two parts, a transmitter and a receiver. In this interface, only the receiver is used. Its purpose is to accept a character consisting of several bits sent sequentially and store these bits in a buffer. The bits are then output on pins 5 through 12 of the UART. For example, the transmission of 0111 1111 (7FH) from the computer to the UART is accomplished one bit at a time on the serial-data port. Pin 12 of the UART will assume the logic level of the least significant bit (the rightmost bit), in this case a logic 1, or +5 volts. The remaining 7 bits are applied to pins 11 through 5, with pin 5 being the most significant bit.

The serial character consists of several parts, each of which can be varied to accommodate specific purposes. The first bit sent is called the start bit; it is used to signal the UART that a character is coming in. Between 5 and 8 data bits are used, 7 to carry the beam heading and one to control the brake. Following the last data bit is one bit used for error-detection; this is called the parity bit. When odd parity is used, the computer will ensure that all characters sent will include an odd number of 1s. If, for instance, two data bits in the character are logic 1, the parity bit will be logic 1. If the three data bits are logic 1, the parity will be logic 0. A parity error will occur if a bit error occurs, as the wrong number of Is will be received. Pin 13 will go to logic 1, indicating the error. Finally, 1, 1-1/2, or 2 stop bits follow, signaling the end of the character.

Since there are many possible character formats, pins 35 through 39 are provided for setting up the UART. They are pulled up to logic 1 by 1.2k resistors and can be set to logic 0 by closing a DIP switch grounding the pin. It is an absolute necessity that the computer and UART be set up exactly the same, or the characters will be incorrectly received. The UART is flexible, so make it conform to the computer.

Parity must be disabled at the computer so that the parity bit is not transmitted. Open the switch tied to UART pin 35 so that it won't look for the bit. I closed the switch tied to pin 36 in order to set the UART for 1 stop bit. Opening this switch sets the UART for 2 stop bits. Pins 37 and 38 are set to logic one by opening the switches. The computer must also be set for 8 data bits and no parity. The state of pin 39 is irrelevant since pin 35 disabled parity.

As well as changing character format, it is possible to set the speed at which the character is received. Different speeds are made possible by applying different clock rates at pin 17, the receiver clock. These clock frequencies are generated by a baud-rate generator. Selection of a particular clock rate, and therefore UART speed, is accomplished with the switch settings on pins 10 through 13 of the baud-rate generator. See Fig. 4 for the proper switch settings for the speed you will run. I found 300 baud to be a good choice.

Testing the UART stage requires that 8-bit characters be output from the computer's serial-data port. Refer to the software section of this article and to your computer's user manual if you are unfamiliar with outputting hex characters. Testing is accomplished as follows:

Apply power and check to see that the UART and baud-rate generator are receiving their proper supply voltages. Now measure the voltages at the programming pins on the UART and baud-rate generator. Plus 5 volts indicates a logic one and an open switch on the pin. If a scope or logic probe is available, check to see that the baud-rate-generator clock output is running. Now transmit 0000 0000 (00H) from the computer to the UART and check to see that pins 5 through 12 are all at logic 0. Next transmit 1111 1111 (FFH) and make sure pins 5 through 12 are at logic 1.

If the outputs change when different characters are received but are not correct, it's probably that the format or speed is incorrect. If the outputs don't change at all when different characters are sent, the UART is not receiving. This can be checked by disconnecting UART pin 18 (reset data available) and typing it to +5 volts with a 1.2k resistor. Send a character to the UART and measure the voltage on pin 19 (data available). It should go to logic 1 as soon as a character is received and will remain at this level until pin 18 is momentarily grounded. If pin 19 never goes to logic 1, the UART is not receiving a character. Disconnect the resistor and reconnect UART pin 18 when this test is completed.

In operation, pin 1 of the 7400 goes to logic 1 when a character is received. On the next clock pulse, pin 2 of the 7400 goes to logic 1. At this point, both NAND-gate inputs are logic I, producing a logic 0 output on pin 3. This output is applied to the UART reset data available, which drops the data-available flag and allows the UART to receive another character. Pin 3 immediately returns to logic 1. This reset pulse on 7400 pin 3 is extremely short and difficult to see without a fast scope.

Digital-to-Analog Converter

Seven of the UART output pins are connected to the digital-to-analog converter (DAC) input pins. As shown in Fig. 5, the most significant bit (MSB) from the UART, pin 5, is not passed to the DAC since it is used to tell the interface that it is allowed to release the brake and turn the rotor. Each character received by the UART is converted by the DAC to an output current on DAC pin 4. By tying pin 4 to +10 volts through a pot, different voltages can be generated depending on the character received. Specifically, output voltage $=10\ V-[(2\ mA\ xR(D/256)]$, where R is the resistance of the pot (set for approximately 5k) and $D=128(B7)+64(B6)+32(B5)+16(B4)+8(B3)+4(B2)+2(B1)+(B0)$.

What this means is that 256 different output voltages between 0 and +10 volts can be generated by the DAC depending upon the input bits. Since only 7 bits are used to indicate the beam headings in the interface, 128 possible output voltages can occur. In order to keep the computer software simple, only 120 possible output voltages will be generated, 00H to 77H. Each of these output voltages corresponds to a specific beam heading. Since the rotor must turn through 360 degrees and 120 different output voltages can be generated, we see that the resolution of the interface is exactly 3 degrees. In operation, the MSB is set to logic 1 to allow rotation by releasing the brake. Therefore, it is necessary

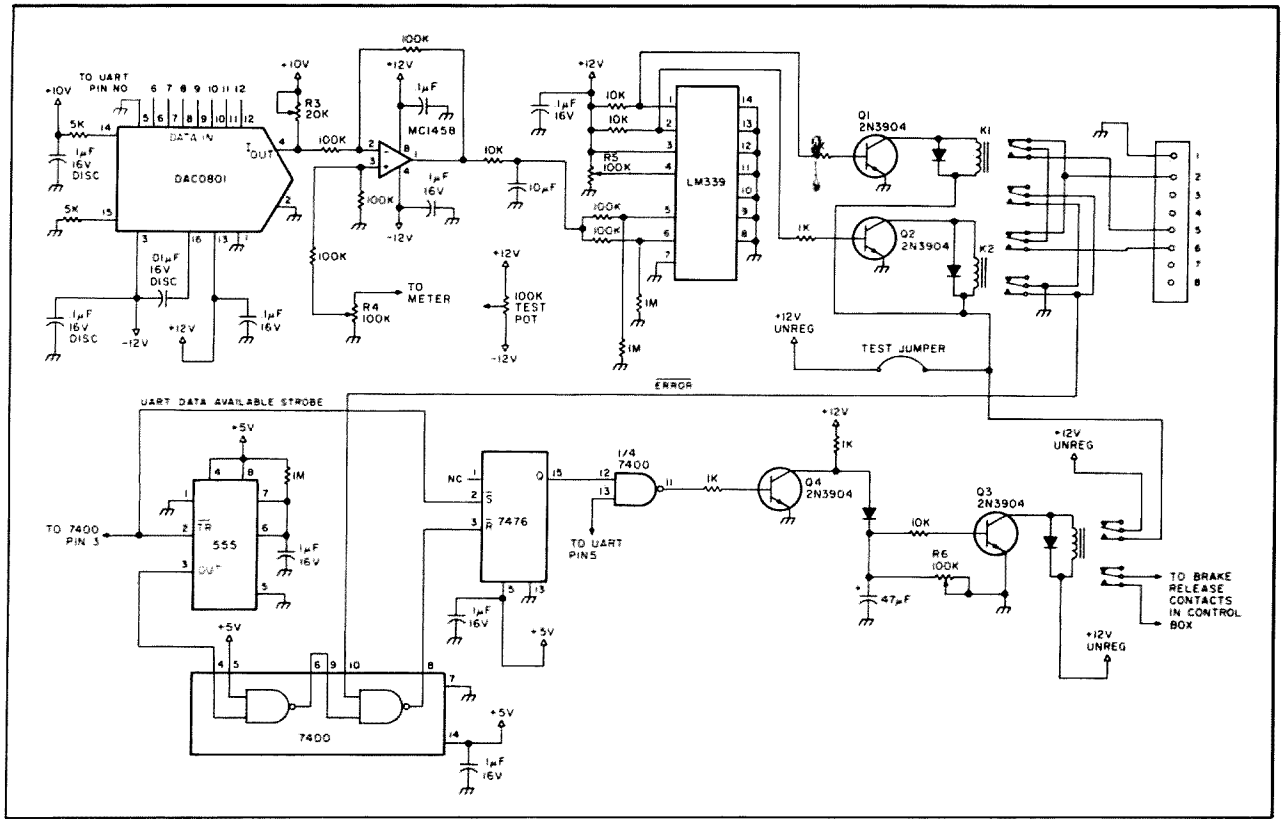


Fig. 5. DAC, rotation control, and brake circuit.

Pin #				
10	11	12	13	Baud Rate
0	0	0	0	50
0	0	0	1	75
0	0	1	0	110
0	0	1	1	134.5
0	1	0	0	150
0	1	0	1	300
0	1	1	0	600
0	1	1	1	1200
1	0	0	0	1800
1	0	0	1	2000
1	0	1	0	2400
1	0	1	1	3600
1	1	0	1	4800
1	1	0	1	7200
1	1	1	0	9600
1	1	1	1	19200

Fig. 4. Baud-rate-generator truth table. Closed switch = logic 0, open switch = logic 1.

to send the characters 80H to F7H to the interface.

In order to test the DAC, check to see that its +12-, +10-, and −12-volt supply inputs are operational. Now send 1111 0111 (F7H) to the UART and check to see that the DAC pins 6 through 8 and 10 through 12 are at logic 1. Pin 9 should be at logic 0 due to the 0 in the input word and pin 5 should be at logic 0 since it is grounded. Now measure the output voltage on DAC pin 4 and adjust R3 for exactly zero volts. This is the only way that R3 can be correctly adjusted. Now send 1000 0000 (80H) to the UART and check to see that DAC pin 4 is approximately +10 volts. Do not adjust R3 to set this 10-volt level. By setting this resistor, the DAC has been adjusted to output between 0 and +10 volts for digital inputs from 77H to 00H.

The output from the DAC is applied to the inverting input of a 1458 comparator. The non-inverting input is connected through a pot to the rotor-box meter. These inputs are compared and an output voltage is produced which is equivalent to the difference between input voltages. The polarity of the comparator output will be either negative or positive depending upon which input voltage is greater. For example, if the DAC output is +2.5 volts and the meter is +1.0 volts, the comparator output will be −1.5 volts.

Construct a test pot by connecting one side of a 100k pot to +12 volts and the other side to −12 volts. Connect the wiper of the test pot to the side of pot R4 labeled "meter input." The control-box meter should not be connected. With the test pot, it will be possible to simulate the voltages which appear on the meter of the rotor box. In order to test the 1458 comparator circuit, first check pins 4 and 8 to see that they are getting power. Send 1011 1111 (BFH) to the interface and check to see that DAC pin 4 is 5 volts. Adjust the test pot so that +5 volts appears on its wiper. Next adjust R44, the input attenuator pot, for +5 volts on its wiper so that it is not attenuating the meter input during testing.

Since the DAC is outputting +5 volts to the comparator and the meter input is at +5 volts, the comparator output should be 0 volts. Reduce the test-pot wiper voltage to +4 volts and check to see that the comparator output on pin 1 is −1 volt. Remember, 5 volts on the input from the DAC minus 4 volts on the input from the wiper equals −1 volt. Adjust the test pot for +10 volts on its wiper and check comparator pin 1 for +15 volts.

In short, the comparator output contains two pieces of information. First, the polarity of its output indicates which direction the rotor must be turned. Second, the magnitude of the output indicates how big the difference is between the actual and the desired direction.

Rotation Control

In order to translate the 1458 comparator output to contact closures for the rotor-control box, two comparators are used. One closes the CCW relay, K2, when the 1458 output is positive, and the other closes the CW relay, K1, when the 1458 output is negative. The contacts of relays K1 and K2 are in parallel across the CW and CCW rotation switches in the rotor-control box. R5 is a threshold adjustment which sets the maximum difference output on the 1458, which can occur before K1 or K2 is closed to rotate the antenna. In operation, this pot will determine how close to the desired direction the rotor will come before coasting to a stop.

Testing of this stage should be performed without any connection between the interface and the rotor-control box. Connect a jumper from unregulated +12 volts to the relay pow-

er wire so that K1 and K2 can be energized without closing K3 (see Fig. 5). This wire is connected to the side of the relay coil not connected to the transistor. Apply power and check for +12 volts on LM339 pin 3. Adjust R5 for approximately 1 volt on pin 4 of the LM339. Send 0111 1111 (F7H) to the interface and check for 0 volts on pin 4 of the DAC. Vary the input voltages on pin 3 of the 1458 by turning the test pot from one extreme to the other. The output on pin 1 of the 1458 should vary between +12 volts and −12 volts. When this output is positive and greater than the threshold voltage on pin 4 of the LM339, approximately 0.7 volts should appear on LM339 pin 2. This will drive Q2 into saturation, closing relay K2. When the 1458 output is negative, pin 1 of the LM339 will be approximately 0.7 volts, driving Q1 into saturation and closing K1. Make sure that K1 and K2 are not closed at the same time.

UART Pin #	Name	Function	
35	No parity	Logic 0	eliminates parity bit
		1	includes parity bit
36	# stop bits	Logic 0	1 stop bit
		1	2 stop bits
37-38	# data bits	Pin 37 Pin 38	Data Bits/character
		0 0	5
		0 1	6
		1 0	7
		1 1	8
39	Odd/even parity	Logic 0	odd parity
		1	even parity

Table 1. UART configuration options. Closed switch = logic 0, open switch = logic 1.

Brake Circuit

At this point, the interface is nearly complete, as it is capable of receiving a character and rotating the rotor to the desired direction. The only remaining requirement is that the brake be released when the rotor is turned.

Looking at the schematic, one might wonder why so many components are used in releasing the brake. Consider what would happen if the operator wants to turn the rotor using the control box rather than the computer. After the rotor turns several degrees, the interface will detect that the rotor is no longer aimed in the direction last specified by the computer. The result would be that it would energize relay K1 or K2 in order to turn the rotor back to the correct direction.

This problem can be overcome by controlling K1 and K2 with the brake circuit. Coil voltage for these relays is interrupted by a set of contacts in K3, the brake relay. Unless K3 is energized, relays K1 and K2 will not close, regardless of what the comparators dictate. The purpose of the 555 timer and 7476 flip-flop is to energize K3 only for as long as is required to bring the rotor to the correct heading after a command from the computer. Once the rotor turns to the correct heading, the relays cannot be re-energized unless a character is received from the computer. Therefore, the rotor control box may be used without interference from the interface.

Operation of the brake circuit commences as soon as a character is received by the UART and the data-available reset is generated on pin 3 of the 7400. This strobe, which will occur every time a character is received, is applied to the 555 and 7476. The 7476 toggles to the on state, outputting a logic 1 on pin 15 which releases the brake. It will remain on until a logic 0 reset pulse is received on pin 3. The reset is normally generated when the rotor reaches the correct direction and K1 and K2 de-energize, allowing 7400 pin 10 to go to logic 1. Pin 8 of the 7400 will then go to logic 0, resetting the 7476 and applying the brake.

Several parts of this stage require explanation. When a character is received from the computer, the brake circuit will energize K3 before the DAC and comparators are finished energizing K1 or K2. Since the contacts of these relays would not be closed, the brake circuit will assume that the rotor is correctly aimed. It would then de-energize K3, stopping the rotation process before it started. The timer prevents the reset from reaching the 7476 for a second after the character is received, ensuring that the relays have time to energize.

Another function of the timer is to generate a reset if the computer tells the interface to turn a direction it is already aimed at. Addition of one gate of a 7400 at the output of the 7476 adds the capability of the computer to cancel or disregard a rotation command. Bit 8, the most significant bit of the character received by the UART, is used as a rotate-enable bit. It is applied to 7400 pin 13 and prevents the 7476 from releasing the brake unless it is at a logic 1. Therefore, to stop rotation, send any character to the interface with the most significant bit set to logic 0 (00H thru 7FH) and the relays will de-energize.

Testing of the brake circuit should begin by checking the 555 and 7476 for proper power-supply input. Turn the test pot to one extreme of its rotation and send 1011 1100 (BCH) to the UART in order to produce a large difference voltage at the output of the 1458 comparator. Notice the MSB is a logic 1 to release the brake. As soon as the character is received, 7476 pin 2 and 555 pin 2 should momentarily go to logic 0. Pin 3 of the 555 should go to logic 1. After a second, 555 pin 3 should return to logic 0. K3 as well as K1 or K2 should be energized due to difference-voltage output from the 1458.

Slowly rotate the test pot so that both K1 and K2 de-energize (the interface will think the antenna is correctly aimed). After a short coasting delay, K3 will also de-energize. The length of this delay should be set to at least a second by adjusting R6. In order to check to see that rotation can be canceled, turn the test pot to one extreme and send 1011 1100 (BCH) to the UART. K3 and either K1 or K2 will energize in order to rate the antenna. Send 0000 0000 (00H) to the UART and see that the relays drop out since the MSB is logic 0.

Installation and Adjustment

Before connecting the interface to the rotor control box, it is necessary that the interface be properly operating as outlined thus far. Disconnect the test pot but leave in the test jumper supplying +12 volts to K1 and K2. Open the rotor control box and locate the PC board which is attached to the back of the meter. Connect the positive lead to either side of the fuse on the PC board which is attached to the meter. Rotate the rotor back and forth and note that the dc voltage on the fuse varies with rotor direction. The voltage at this point tells the interface which direction the rotor is aimed. Connect the side of R4 labeled "to meter" to either side of this fuse. (*Not the 120-volt power fuse!*) Connect terminal #1 on the interface terminal strip to terminal #1 on the rotor box. Measure the resistance between interface ground and the control-box chassis. It should be about zero Ohms.

Apply power to the interfaced and turn to the rotor control box. Adjust R5 to obtain 1 volt on pin 4 of the LM339. Send 1111 0111 (F7H) to the interface and adjust R3 for exactly 0 volts on pin 4 of the DAC0801. Send 1000 0000 (80H) to the interface and check that the voltage on pin 4 of the DAC is between +8 and +10 volts. Using the control box, rotate the rotor fully clockwise to the south. The meter output voltage should be between +8 and +10 volts. With the rotor turned clockwise to the south, adjust R4 so that is wiper voltage is exactly the same as the voltage on pin 4 of the DAC0801. An easy way to do this is to measure the difference-voltage output on pin 1 of the 1458 comparator. Adjust R4 so that this voltage is exactly 0 volts. These adjustments have set the DAC and meter outputs to operate over the same range of voltages.

Instruct the interface to turn the rotor north by sending 1011 1100 (BCH) to the interface. K3 and K2 should energize. Turn the rotor north using the control box and note that K2 followed by K3 will drop out at some point during the rotation. The exact point at which K2 will de-energize is dependent upon the threshold setting of R5. This adjustment set how much before the desired heading is reached the rotor will begin to coast to a stop. Setting too tight a tolerance will cause the interface to hunt back and forth for an exact heading. I found a tolerance of about 5 degrees works reliably. The adjustment is made by turning the rotor 5 degrees clockwise from north using the control box and then sending 1011 1100 (BCH) to the interface. Adjust R5 so that K2 is just on the border of de-energizing.

ROTOR HEADING ON CONTROL BOX METER

183°	210°	240°	270°	300°	330°	360°	30°	60°	90°	120°	150°	180°
F7	EE	E4	DA	D0	C6	BC	B2	A8	9E	94	8A	80

HEX CHARACTER SENT TO INTERFACE

Rotor Direction	Hex Character	Decimal Character
0	BC	188
3	BB	187
6	BA	186
.	.	.
.	.	.
.	.	.
180	80	128
183	F7	247
186	F6	246
.	.	.
.	.	.
.	.	.
354	BE	190
357	BD	189
360	BC	188

Fig. 6. Matrix look-up table.

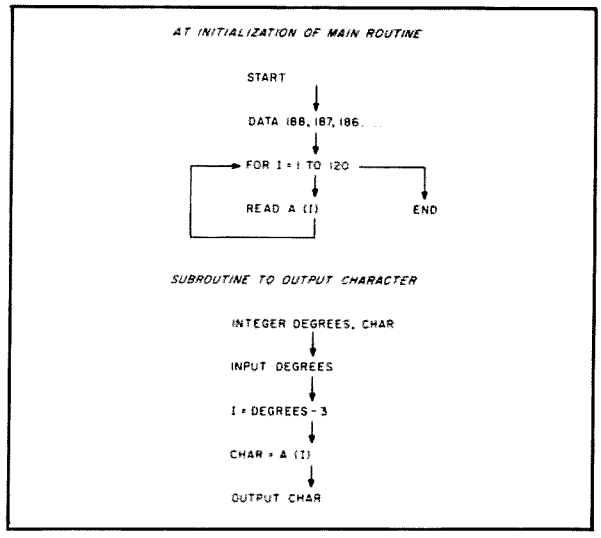


Fig. 7. Flowchart for look-up table in Basic.

Disconnect the test jumper and connect terminals 2, 5, and 6 on the interface terminal strip to terminals 2, 5, and 6 respectively on the rotor control box. Do not disconnect the wires already on these terminals. Relay K3 has two wires connected to its normally-open contacts labeled "to brake relay." These wires should be connected in parallel across the contacts of the brake-release switch in the rotor box. This will release the brake when K3 energizes.

Apply power to the interface and the rotor control box and send 1000 0000 (80H) to the interface and note that K3 and K1 will energize, turning the rotor clockwise to the south. After rotation has stopped, send 1011 1100 (BCH) to the interface and note that K3 and K2 will close, turning the antenna to north, where it will stop. Send 1111 0111 (F7H) to the interface and the rotor will turn counterclockwise to the south. Finally, test the stop function by sending the interface a command to turn followed by a 0000 0000 (00H). This will stop the rotation.

Software

Before reviewing the program which will send data to the interface, it is necessary to understand the software requirements. Normally, rotor direction is expressed as 360 points on a circle (called degrees). Zero degrees is north and the number of degrees increases with clockwise rotation. The interface uses a different system, however. This is due to the design of the meter circuit in the rotor control box. In this system there are 120 directions, each of which is 3 degrees in width. The software is able to control rotor direction by telling the interface to go to one of these direction.

Communication between the computer and the interface is in a binary string of 1s and 0s. Seven binary bits are required to specify 120 rotor headings, and the 8th (MSB) bit is used for brake control. The way the program specifies the string of bits varies with different computers and software packages.

In the hexidecimal system, 4 bits are grouped together to form a hex digit. Since 4 bits can form 16 different combinations, the hex digit must be able to represent all possibilities. This is accomplished by counting as follows: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. Since we need to represent 8 bits, it will be necessary to form a word containing 2 hex digits. For use with the interface, the range of the word will be from 80 hex (1000 0000) to F7 hex (1111 0111), as shown in Fig. 6. Those that are writing the program in assembly language will send a hex word to the communications port of the computer.

A different method is used when running Basic. In this system, the decimal value of the output word is placed on the serial port. The decimal equivalent of the output string is calculated by assigning values to bit positions. The value of the 8 bit positions is as follows; 128, 64, 32, 16, 8, 4, 2, and 1. For instance, the equivalent of 1000 0010 is 128+2 or 130. Only 128 and 2 were counted since these were the positions where 1s occurred in the bit string. The decimal outputs corresponding to different directions are shown in Fig. 6. Check your software manual to determine how to send the character to your serial port.

I will describe two ways which the output character can be generated in software. Regardless of which method is chosen, I suggest that the program be implemented as a subprogram or subroutine. This way the software for driving the interface can be accessed at multiple points in a main program. The software will also remain constant regardless of which main program it is used with.

A simple program to implement is one which uses a look-up table to obtain the character to be sent to the interface. The table contains either hex or decimal output characters associated with different directions. The most elementary way of using the table would be for it to consist of 360 entries, each associated with a rotor heading in degrees. If, for instance, the software must turn the rotor to 70 degrees, it would go to the 70th entry in the table, obtain the character at that location, and send it to the interface. The output character for 250 degrees would be contained at the 250th memory location and so on. This system is easy to use because there is no need to relate rotor heading in degrees to the direction number and then convert to an output character. This is done when the table is written.

Since there are only 120 different directions, and therefore output characters, a table of this type would have each output character repeated 3 times in 3 adjacent memory locations. Since no purpose is served by wasting memory, the table can be reduced to 120 entries. The flowchart in Fig. 7 shows how a look-up-table program can be implemented in Basic. When the main program is started, the variables A(0) to A(120) are loaded with the decimal-output characters in the look-up table of Fig. 6. A(0) is loaded with 188, A(1) with 187, etc.

Also shown in Fig. 7 is a subroutine which retrieves output characters from the look-up table. When a rotor heading is received by this routine, an integer division is performed to obtain "I"—which is used as a subscript for A(I). The decimal-output character stored in A(I) is then output to the serial port. For example, suppose the rotor is to turn south to 180 degrees. The routine receives 180, then divides by 3 to obtain the integer 60. The decimal stored in A(60) is loaded into the variable "char" and sent to the serial port.

It is also possible to write this routine in assembly language. If this is done, the value of "I" is used as an offset from the base address of the look-up table.

Another way to generate the output character is to calculate it. Although more time will be required to run this routine, it requires less memory than the look-up table method. Fig. 8 shows the flowchart which creates the character through successive substations.

Regardless of which method is chosen, the software can be tested for proper output by inputting a rotor heading in degrees. Have the program print the character it would output to the interface. This way the software can be

tested without spinning the rotor back and forth.

Conclusion

When completed, the interface can be mounted in a case or inside the rotor control box on the bottom side of the chassis. If this is done, it will be necessary to fit the transformers and relays on top of the chassis. I experimented by using miniature relays instead of those specified and found that they can work for a limited time before the contacts melt. Don't waste time and money on them.

For those who would like the interface to notify the computer that the proper heading has been reached, all that needs to be done is to add a line driver on the serial output of the UART. Let the reset that goes to the 7476 trigger the UART transmitter. The character that the UART sends to the computer can be selected using the UART transmit-data pins.

Another idea that I've been thinking about is an improved brake circuit that detects when the rotor has coasted to a stop (rather than waiting several seconds and applying the brake). A differentiator could be constructed so that it outputs a logic 1 as long as there is a change taking place on the meter. When the meter stops changing, the circuit would output a 0. Therefore, when the rotor coasts to a stop, the differentiator output goes to logic 0 and the interface applies the brake. If the differentiator output were then connected to a circuit which looks at the comparator output voltage from the 1458, it would be possible to detect a stalled rotor. Stalling would be indicated if the comparator had a difference voltage present on its output but rotor motion was stopped. I did not include this in the article as it wasn't essential to operation.

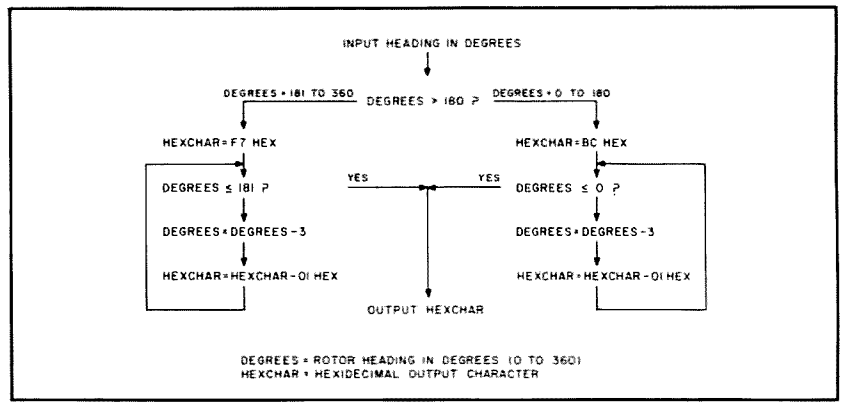


Fig. 8. Calculation of output character.

A final thought regarding the computer software. There are numerous applications for this circuit which can be implemented in the main program: rotation linked to a great circle program, direct heading entry via keyboard, timed rotation slaved to the computer clock (satellite tracking), etc. Who will be the first to implement total computer control of the shack? All the pieces are available: computer-interfaced HF rigs, CW/RTTY readers/generators, and now an antenna.

Good luck, and happy rotoring! ■

Parts List

ICs			
1	TI7812 regulator (12v)	RS276-1771	$1.59
1	TI7805 regulator (5v)	276-1770	1.59
1	μa723 regulator		2.79
1	LM337 regulator	276-1179	3.99
1	DAC0801 D/A converter	276-1791	3.49
1	MC1458 op amp		1.69
1	LM339 op amp	276-1712	1.59
1	NE555 timer	276-1723	.99
1	7476 JK flip-flop		1.59
1	7400 NAND gate	276-1801	.59
1	1489 line receiver	276-2521	1.79
1	AY-3-1015-D or equivalent UART	276-1794	5.95
1	COM5046 or equivalent baud-rate generator		3.00
IC Sockets			
5	14-pin, wire-wrap		.30
3	16-pin, wire-wrap		.30
3	8-pin, wire-wrap		.30
2	40-pin, wire-wrap		1.75
Resistors			
1	120 Ohms, 1/4 W		.10
1	130 Ohms, 1/4 W		.10
1	560 Ohms, 1/4 W		.10
1	620 Ohms, 1/4 W		.10
4	1k Ohms, 1/4 W		.10
5	1.2k Ohms, 1/4 W		.10
1	2.7k Ohms, 1.4 W		.10
2	5k Ohms, 1/4 W		.10
4	10k Ohms, 1/4 W		.10
6	100k Ohms, 1/4 W		.10
3	1 megohm, 1/4 W		.10
Variable Resistors			
2	1k mini-pot	271-0333	.49
1	20k mini-pot	271-0336	.49
4	100k mini-pot	271-0338	.49
Capacitors			
1	100 pF	272-123	1.39
1	.01-uF, 16-V disc	272-131	.39
10	.1-uFD, 16-V disc	272-135	.49
2	1-uF tantallum, 15 V		1.59
1	1-uF, 16-V electrolytic	272-996	.79
1	10-uF nonpolarized electrolytic	272-999	.99
1	47-uF electrolytic	272-1027	.69
1	470-uF, 35-V electrolytic	272-1081	.99
Miscellaneous			
1	Female DB-25 connector		3.00
1	Data cable from computer to interface		
4	Diodes (pkg. of 50)	276-1620	1.39
4	2N3904 transistors (pkg. of 15)	276-1603	
3	DPDT 12-volt relays	276-206	3.99
1	8-switch DIP switch	275-1301	1.99
1	4-switch DIP switch	275-1304	1.99
1	12-V, 1.2-A transformer	273-1505	3.99
1	12-V, 0.2-A transformer	273-1785	3.29
2	Bridge rectifier packs, 50 V, 2 A	276-1151	1.59
1	5.0688-MHz crystal, HC-18/U or HC-25U, AT cut 50-Ohm series resistance, series resonent .01% tolerance	(Northern Engineering Labs, Burlington WI, (414)-763-3591; or Bulova Frequency Control Products, Woodside NY, (212)-335-6000.)	3.00
			$75.81

CONTESTS

Robert W. Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARRL VHF QSO PARTY
Starts: 1800 UTC June 14
Ends: 0300 UTC June 15

The object of this ARRL-sponsored contest is to work as many amateur stations in as many different ARRL sections and countries as possible using authorized amateur frequencies above 50 MHz. Note that these rules were taken from previous year's contests, with 902 MHz now counting 3 points. No other changes were anticipated. Check *QST* for any last-minute changes.

Operating categories include single operator using multi- or single band, or multi-operator. Single-operator stations must use one person for all operating and logging functions. Single-operator stations may submit single-band scores for 50, 144, 220, 432, and 1296-and-up categories. Contacts may be made on any and all bands without jeopardizing single-band entry status. Such additional contacts are encouraged and should be reported.

Multi-operator stations must locate all equipment (including antennas) within a 300-meter circle.

Stations may be worked once per band regardless of mode. Each QSO must be acknowledged; one-way exchanges do not count. Foreign stations may work only stations in the U.S., Canada, and U.S. possessions for contest credit.

Retransmitting either or both signals, or use of repeater frequencies is not permitted. Contest entrants may not transmit on repeaters or repeater frequencies on 2 meters to solicit contacts. Use of the national calling frequency, 146.52, or immediate adjacent guard frequencies is also prohibited. Only recognized simplex frequencies may be used, such as 144.90–145.10; 146.49, .55, and .58; and 147.42, .45, .48, .51, .54, and .57. Local option simplex channels and frequencies adjacent to the above that do not violate the intent of the contest rules or the spirit and intent of the band plans as recommended in the *ARRL Repeater Directory* may be used for contest purposes.

All operation must be fixed, portable, or mobile and under one call from one ARRL section. A transmitter used to contact one or more stations cannot be used under any other call during the contest period, with the exception of family stations where more than one call is assigned to one location by FCC/DOC. Also, one operator may not give out contest QSOs using more than one callsign from any one location.

Only one signal per band at any given time is permitted, regardless of mode. While no minimum distance is specified for contacts, equipment should be capable of real communications (i.e., able to communicate over at least a mile). Multi-operator stations may not include QSOs with their own operators except on frequencies higher than 2.3 GHz. Even then, a complete, different station must exist for each QSO made under these conditions.

Above 300 GHz, contacts are permitted for contest credit only between licensed amateurs of Technician class or higher using coherent radiation on transmission (e.g., laser) and employing at least one stage of electronic detection on receive.

EXCHANGE:

Name of section, VE province, or DX country. Must be acknowledged by both operators for credit by either.

SCORING:

Count one point for each complete 50- or 144-MHz QSO, 2 points for a 220- or 420-MHz QSO, and 3 points for 902-MHz or 1215-MHz-and-above QSO. Crossband QSOs do not count.

Mutipliers count once per band: each ARRL section in the contiguous 48 states (63 max.), each Canadian province (12 max.), and each DXCC country (excluding W and VE).

REPORTING:

Entries must be postmarked no later than July 11th and sent to: ARRL Headquarters, Newington CT 06111. Official entry forms are available from the same address for an SASE. Usual ARRL disqualification rules apply. Usual awards to top scorers in each ARRL section, some limited to where significant effort or competition is evidenced. Multi-operator entries are not eligible for single-band awards.

WORLDWIDE SOUTH AMERICA CW CONTEST
Starts: 1500 UTC June 14
Ends: 1500 UTC June 15

Sponsored by *Electronica Popular* magazine of Rio de Janeiro, Brazil, this contest will be held annually on the second complete weekend of June. Use all bands from 160 through 10 meters on CW only; crossband contacts are not valid. Work stations worldwide. Entry classes include single operator/single band or all bands, and multi-operator/single transmitter (multiband only).

EXCHANGE:

RST and consecutive QSO number starting with 001.

SCORING:

Each QSO within your own country counts zero points—it only counts as a multiplier. QSOs within same continent are 2 points; QSOs outside your continent are 4 points each. Contacts with South American stations (only for outside South America) count 8 points per QSO. Multipliers are the number of different DXCC countries and different South American prefixes worked on each band. Final score is the total QSO points multiplied by the sum of total multipliers in each band.

AWARDS AND ENTRIES:

Certificates will be awarded to the three top-scoring stations in each class for each country with a reasonable score provided. A separate log for each worked band must be sent no later than August 31st to WWSA Contest Committee, PO Box 18003, 20772 Rio de Janeiro, RJ, Brazil. Include a self-

CALENDAR

Jun 14–15	ARRL VHF QSO Party
Jun 14–15	Worldwide South America CW Contest
Jun 28–29	ARRL Field Day
Jul 1	CARF Canada Day Contest
Jul 12–13	IARU Radiosport Championship
Aug 2–3	ARRL UHF Contest
Aug 16–17	New Jersey QSO Party
Aug 16–17	New Mexico QSO Party
Sep 13–14	ARRL VHF QSO Party
Oct 11–12	Rio CW DX Party
Nov 1–2	ARRL Sweepstakes—CW
Nov 15–16	ARRL Sweepstakes—Phone
Dec 5–7	ARRL 160-Meter Contest
Dec 13–14	ARRL 10-Meter Contest
Dec 28	CARF Canada Contest

ZERO BEAT

NEWSLETTER OF THE MONTH

This month's winner is Zero Beat, the newsletter of the Hampden County (Massachusetts) Radio Association. Most of the most recent issue is taken up with a reprint of an article from *73* (that isn't why it won–we're trying to make a point here). If you see something in *73* that you'd like to reprint in your newsletter, drop us a note saying what you'd like to do. That's what Zero Beat did, and we were only too happy to help 'em out.

To enter your club's publication in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Newsletter of the Month.

addressed envelope with IRCs for a copy of the results. (*Note: See Brazil column in 73 International.*)

ARRL FIELD DAY
Starts: 1800 UTC June 28
Ends: 2100 UTC June 29

Note that these rules were taken from previous years' contests and no changes were anticipated other than the availability of the 24-MHz band. Check *QST* for any last-minute changes.

Sponsored by the ARRL, the contest is open to all amateurs in the ARRL Field Organization plus Yukon and NWT. Foreign stations may be contacted for credit, but are not eligible to compete. The object is to work as many stations as possible under less-than-ideal conditions. Operating times are limited depending on your operating class; check rules below.

Entry categories are classified by the maximum number of simultaneous transmitted signals, followed by the designation of the nature of the individual or group participation. Below 30 MHz, a transmitter must remain on a particular band for at least 15 minutes once used for a contact on that band. During this 15-minute period, the transmitter is considered to be transmitting a signal (even if it is not) for purposes of determining transmitter class. Switching devices are prohibited.

Class-A consists of club and non-club portable stations specifically set up for Field Day. Such stations must be located in places that are not regular station locations. They must use neither facilities installed for permanent station use nor any structures installed permanently for FD use. Stations must be operated under one callsign and under the control of a single licensee or trustee for each entry. All equipment (including antennas) must lie within a 300-meter circle. All contacts must be made with transmitters and receivers operating independently of commercial mains. Entrants who, for any reason, operate a transmitter or receiver from commercial mains for any contacts will be listed separately at the end of their class.

Any Class-A group whose entry classification is two or more transmitters (non-Novice) may also use one Novice/Technician operating position (Novice bands only) without changing its basic entry classification. This station (including antennas) should be set up and operated by Novice and Technician licensees and should use the callsign of one of these operators.

Class-B consists of non-club portable stations set up and operated by not more than two licensed amateurs. Other provisions are the same as for Class-A.

Class-C consists of mobile stations in vehicles capable of operation while in motion and normally operated in this manner, including antenna. This includes maritime and aeronautical mobiles.

Class-D consists of stations operating from permanent or licensed station locations using commercial power. This group of stations may count only contacts made with Class A, B, C, and E Field Day groups for points.

Class-E stations are the same as Class-D except they use emergency power for transmitters and receivers. They can work stations in all classes.

Operators participating in FD may not contact for point credit the FD portable station of a group with which they participate. Any station used to contact one or more FD stations may not be used under any other call during the FD period, except for family stations.

Each phone and each CW segment is considered a separate band. All voice contacts are equivalent, and RTTY/ASCII is counted as CW. A station may be worked once on each band; crossband contacts are not allowed. The use of more than one transmitter at the same time in a single band is prohibited, except that a Novice/Technician position may operate on any Novice band segment at any time. No repeater contacts—but the 24-MHz band may now be used.

EXCHANGE:

Stations in any ARRL section send Field Day operating class and ARRL section. A four-transmitter station in NJ would send "4A NJ." Foreign stations send RS(T) and QTH.

SCORING:

Scores are based on the number of valid contact points times the multiplier corresponding to the highest power used at any time during the FD period, plus bonus points. Phone contacts are one point each; CW contacts are two points each. Power multipliers are: 5 for using a dc input power of 10 W (20 W PEP) or less (or 5-W-dc output/10-W-PEP output) if a power source other than commercial mains or motor-driven generator is used; 2 for using a dc input power of 200 W or less on CW and 400 W PEP or less on SSB; 1 for using anything higher.

Batteries may be charged while in use for Class-C entries only. For other classes, batteries charged during the FD period must be charged from a power source independent of the commercial mains.

Bonus points will be added to the score (after the multiplier is applied) to determine the final score. Only Class-A and -B stations are eligible for bonuses:

1) *100% Emergency Power*—100 points per transmitter for 100% emergency power. All equipment and facilities at the FD site must be operated from a source independent of the commercial mains.

2) *Public Relations*—100 points for public relations. Publicity must be obtained or a bona fide attempt to obtain publicity must be made, or operation must be conducted from a public place (such as a shopping center). Evidence must be submitted in the form of a clipping, a memo from a BC/TV station that publicity was given, or a copy of material that was sent to news media for publicity purposes.

3) *Message Origination*—100 points for origination of a message by the club president or other FD leader, addressed to the SM or SEC, stating the club name (or non-club group), number of operators, field location, and number of ARES members participating. The message must be transmitted during the FD period, and a fully serviced copy of it must be included with the FD report. The message must be in standard ARRL message form or no credit will be given.

4) *Message Reply*—10 points for each message received and relayed during the FD period, up to a maximum of 100 points. Copies of each message, properly serviced, must be included with the FD report.

5) *Satellite QSO*—100 points can be earned by completing at least one QSO via satellite during the FD period. The repeater provision is waived for satellite QSOs and a satellite station does not count as an additional transmitter. Show satellite QSOs as a separate band on the summary sheet.

6) *Natural Power*—FD groups making a minimum of 5 QSOs without using power from commercial mains or petroleum derivatives can earn 100 points. This alternative power source also includes batteries charged by natural means (not dry cells). The natural-power station counts as an additional transmitter. If you do not want to change your entry class, take one of your other transmitters off the air while making the natural-power QSOs. A separate list of natural-power QSOs should be enclosed with your entry.

7) *W1AW Message*—A bonus of 100 points will be earned by copying a special ARRL FD bulletin sent over W1AW on its regularly announced frequencies just before and during FD. This message can be received directly from W1AW or by any relay method. An accurate copy of the received message should be included in your FD report.

REPORTING:

Entries must be postmarked by July 24th; no late entries can be accepted. A complete entry consists of a summary sheet and a list of stations worked on each band/mode during FD, plus bonus proof. The list of stations worked on each band or mode may take the form of official ARRL dupe sheets or an alphanumeric listing of callsigns worked per band and mode. This list may be computer generated. Incomplete or illegible entries will be classified as check logs. A copy of FD logs should be kept by your FD group but should not be sent in unless specifically requested by ARRL. Normal ARRL disqualification rules apply.

All entries and requests for official forms should be addressed to: ARRL, Newington CT 06111. Include a 9 x 12 self-addressed envelope with 3-oz. postage for a complete Field Day entry package.■

HAM HELP

Does anyone know where I can get two of the vinyl cases that were available in Canada for awhile for the ICOM 2AT and 4AT with BP-5 batteries? I'm also looking for information on SSTV—right now I can only receive. I need active frequencies to monitor.

Scott Harvey KA7FVV
N. 5011 Idaho Rd.
Newman **Lake WA 99025**

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Ahem, now, if you all will just kind of hum along...

Old Macintosh had some disks,
E-I-E-I-O
And on each disk was a program,
E-I-E-I-O
With a spreadsheet here,
And a data base there,
Paint a house,
Click a mouse,
Even programs for his spouse;
Old MacIntosh had some disks,
E-I-E-I-O
But when he wanted TTY,
E-I-E-I-O
There was no program he could buy;
E-I-E-I-O
So he checked on CIS,
And the BBS,
Log on in,
Search around,
Not a damn thing he has found!
Then Old Mac had one last hope...
Write to RTTY Loop! [Lope?–Ed.]

Only one problem, I am hard pressed to find anything either! I have received several letters in the last few months, all of which are asking for help in putting a Macintosh computer onto RTTY. Agust Bjarnason TF3OM in Gardabaer, Iceland, is just one of the hams trying to get onto MacRTTY. Sorry to say, but I have asked around to all my usual sources, including HamNet on CompuServe, and have come up blank. As of today, even the sysop on that system acknowledges that MacRTTY programs have been few and far between.

Well, are any of you out there willing to share your secrets? There must be someone who has interfaced a Mac to RTTY. I know there are many more who want to find out. Please drop me a line at the above address, and I will pass along the information to the mass MacMultitudes (sorry!).

One system I have obtained some recent information on is the "expanded" CoCo. A few months ago, I reviewed several accessory boards available for the Radio Shack Color Computer® which added a true serial and parallel interface, real-time clock, and 80-column display. All of these boards were produced by PBJ, Inc., and appeared to represent real improvements to an already fine machine.

With the introduction of the new version of the OS-9 operating system, several changes have surfaced with these boards, and I would like to quote you from a letter received from Donald Beane of PBJ. In a press release, he states, "effective February 1, 1986, we started shipping a new version of the WordPak. It is being manufacturered for Radio Shack's new version of OS-9, Rev. 2.0, and is available through their Express Order Catalog. In order to conform with Radio Shack's planned expansion devices, the new WordPak has been relocated to a new address (HFF76-79). This was required to avoid conflict with existing and/or planned devices. The cartridge is essentially the same as the original WordPak, except that it provides the larger character matrix of the WordPak II, and inverse video is implemented in the same manner as on the WordPak II. The price of the WordPak-RS is $99.95 and it is supplied with the OS-9 driver."

Mr. Beane indicated that nei-

FREQ	SB	SH	BD	SVC	CALL
2024	U	85	50M	AP/UPI	AFRTS
4045	U'	85	50M	AP/UPI	AFRTS
4515	U'	85	50M	AP/UPI	AFRTS
4620	U'	85	50M	AP/UPI	AFRTS
5435	L'	425	74	VOA	VOA
5460	L'	425	74	VOA	VOA
6834	U'	85	50M	AP/UPI	AFRTS
6853	U	425	50	REUTER	GPE26
6941	U'	170	74	VOA	VOA
6983	U'	425	50	AP	GIC26B
6992	U'	85	50M	AP/UPI	AFRTS
7442	U'	425	74	VOA	VOA
7478	U'	425	74	VOA	VOA
7534	U'	85	50M	AP/UPI	AFRTS
7784	U'	85	50M	AP/UPI	AFRTS
7970	L	425	50	PL	
8000	U'	85	50M	AP/UPI	AFRTS
8022	L'	425	50	AFP	
8029	U'	85	50M	AP/UPI	AFRTS
8148	U	85	50M	AP/UPI	AFRTS
8182	L	425	50	UPI	PDK68
8192	L'	425	50	PAP	SOI31
8506	U'	85	50M	AP/UPI	AFRTS
9050	U'	85	50M	AP/UPI	AFRTS
9053	L'	425	50	ANSA	ISX90
9070	U	425	50	REUTER	
9080	U	425	50	REUTER	
9102	U	425	50	REUTER	
9120	U'	425	50	REUTER	GPN29
9214	U'	85	50M	AP/UPI	AFRTS
9259	U'	85	50M	AP/UPI	AFRTS
9285	U'	85	50M	AP/UPI	AFRTS
9349	U'	425	50	AP	GIC29B
9381	U'	85	50M	AP/UPI	AFRTS
9397	L'	425	50	AFP	FTJ39A
9405	U'	85	50M	AP/UPI	AFRTS
9855	L'	425	74	VOA	VOA
10134	U'	85	50M	AP/UPI	AFRTS
10185	L	425	50	AFP	FPK8
10410	L'	425	74	VOA	VOA
10413	U'	85	50M	AP/UPI	AFRTS
10460	U'	425	74	U.N.	4UZ
10543	L'	425	50	ADN	
10598	U'	425	50	VNA	VNA25
10616	L'	425	50	AFP	FTK61
10648	U'	425	50	AP	GIC30B
10785	L'	425	50	ADN	Y2V43B
10879	U'	425	50	TASS	
10880	U'	425	74	VOA	VOA
10882	L'	425	50	REUTER	
10905	U'	85	50M	AP/UPI	AFRTS
10958	U'	425	50	REUTER	GPE30B
10960	U'	425	50	REUTER	GPE30
10972	L'	425	74	VOA	VOA
10985	U	425	50	BAK	RCB53
11004	U'	85	50M	AP/UPI	AFRTS
11048	U'	85	50M	AP/UPI	AFRTS
11170	L'	425	50	KCNA	
11539	U'	85	50M	AP/UPI	AFRTS
11540	L	425	50	REUTER	GPE30B
11599	U'	85	50M	AP/UPI	AFRTS
11622	U'	425	50	PAP	SOL36
12085	U	425	50	BAK	RCB55
12128	L'	425	50	ANSA	IRJ31
12185	U'	425	50	JANA	
12224	L'	425	74	VOA	VOA
12280	U	425	50	AP	GBU32
13238	U	85	50M	AP/UPI	AFRTS
13410	L	425	50	VNA	VNA16
13438	L'	425	50	DPA	
13460	U'	425	50	VNA	VNA16
13487	L'	425	50	ANSA	ISX35
13490	U	425	50	BAK	RCG77
13493	U	425	50	TASS	RCG77
13504	L	425	50	KCNA	MVS19
13563	U'	850	50	CNA	3MA22
13580	L'	425	50	KCNA	MVS19
13598	L	425	50	CETEKA	
13612	U	425	50	REUTER	
13623	U'	425	50	REUTER	
13625	U'	425	50	REUTER	
13626	U'	425	50	REUTER	
13628	U	425	50	REUTER	
13648	L'	425	50	CETEKA	
13652	U'	425	50	MENA	SUA50
13676	U'	85	50M	AP/UPI	AFRTS
13730	L'	425	50	AFP	
13770	L'	425	74	VOA	VOA
13895	L'	425	50	ADN	Y2V47
13898	L	425	50	ANSA	
13975	L'	425	50	ANSA	ISX19
13995	L'	425	74	VOA	VOA
14360	U	425	50	PAP	
14366	U'	425	50	XINHUA	
14387	U'	85	50M	AP/UPI	AFRTS
14420	U'	85	50M	AERO	AFRTS
14420	U'	85	50M	AP/UPI	AFRTS
14469	U'	425	50	TASS	
14490	U	425	50	TASS	RNK36
14513	U	425	50	REUTER	GPN34
14523	U	425	50	REUTER	GPN34
14525	L'	425	74	VOA	PRS
14547	L	425	50	KYODO	JAL44
14562	U'	85	50M	AP/UPI	AFRTS
14565	U'	425	50	PL	
14568	L	425	50	KCNA	HML61
14572	U'	425	50	JANA	
14631	L'	425	50	ANSA	
14638	L'	425	74	ARF	WFK54
14698	U'	425	50	TASS	REB24
14718	U'	425	50	KYODO	
14720	U	425	50	BAK	RKB58
14762	U	425	50	GNA	
14796	L'	425	50	AFP	
14800	L	425	50	ADN	DMV24
14825	L'	425	50	ADN	Y2V25
14832	U	425	50	KUNA	
14901	L'	425	50	PL	CLN450
14901	L'	425	50	TASS	
14928	L'	425	50	PL	CLN452
14974	U'	425	50	AP	GBW34B
15462	L'	425	50	JANA	
15480	L'	425	50	KCNA	
15482	L'	425	50	APS	
15506	L'	425	50	CETEKA	
15693	L'	425	50	ANSA	ISX56
15694	L'	425	50	ANSA	ISX56
15743	L'	425	50	VNA	VNA5
15749	U'	85	74	VOA	VOA
15750	U'	85	74	VOA	VOA
15865	U	425	50	BAK	RBK79
15865	U'	425	50	TASS	RRG26
15875	L'	425	74	VOA	VOA
15896	U'	85	50M	AP/UPI	AFRTS
15898	L'	425	50	CETEKA	
15930	U	425	50	BAK	RBI78
15977	L'	425	50	AFP	
15980	L'	425	50	AFP	
15992	U'	425	50	INDFO	WER26
15996	L'	425	50	DPA	
16055	U	425	50	INDFO	WER45
16092	U'	85	50M	AP/UPI	AFRTS
16108	L'	425	50	AFP	
16133	U'	85	50M	AP/UPI	AFRTS
16135	U'	425	50	XINHUA	BZP54
16149	U	425	50	NEWS	
16223	U	850	50	CNA	3MA35
16247	U'	425	50	PL	
16336	U'	425	50	PL	
16342	U'	425	50	TANJUG	YZJ4
16347	U'	425	50	TASS	
16348	U'	425	50	PL	
16348	U'	425	50	TASS	
16380	U'	425	50	PL	
16384	U	425	50	VNA	VNA30
16403	L'	425	50	ADN	Y2V57
16415	L	425	50	ADN	
17210	L	170	74	AFRTS	
17210	U	425	50	XINHUA	
17370	U	425	50	BAK	RBI73
17390	U	425	50	PL	
17393	L'	425	50	PL	CLN565
17415	L	425	50	PL	
17475	L	425	50	PL	
17509	U	425	50	TASS	RFD53
17519	U	425	50	TASS	
17525	L	425	50	CETEKA	OLV3
17545	L'	425	50	AFP	
17552	U	85	50M	AP/UPI	AFRTS
17555	U'	425	50	MAP	CNM73
17564	U'	85	50M	AP/UPI	AFRTS
17565	U	425	50	AP	GIW37B
18005	L	425	50	PL	CLN603
18012	U	425	50	PL	
18050	U'	425	50	TASS	
18101	U'	425	50	REUTER	GPU30
18159	U	425	50	TASS	RTU47
18193	U'	425	50	PL	CLN603
18198	U'	425	50	PL	
18205	U'	85	50M	AP/UPI	AFRTS
18245	U	85	50M	AP/UPI	AFRTS
18261	L'	425	50	KUNA	
18272	U	85	74	VOA	VOA
18292	U	425	50	PL	
18307	L'	425	50	KUNA	
18331	U	425	50	REUTER	
18333	U'	425	50	REUTER	GPE38B
18335	U'	425	50	REUTER	GPE38
18384	U	425	50	TASS	REB24
18392	U'	85	50M	AP/UPI	AFRTS
18434	U'	85	50M	AP/UPI	AFRTS
18519	L'	85	50	AFP	
18540	U	425	50	PL	
18543	L'	425	74	ARF	WFK48
18547	U	425	50	AP	GIY38B
18671	L'	425	50	AFP	FTS67
18675	L	425	50	IINA	
18682	U	425	50	REUTER	
18700	L'	425	50	DPA	
18787	U'	425	50	SUNA	
18824	L'	425	50	ADN	Y2V38A
18835	U'	425	50	TASS	RWN74
18871	U	425	50	XINHUA	
18988	L	425	50	CETEKA	
19148	U	425	50	XINHUA	BAJ29
19162	U'	85	50M	AP/UPI	AFRTS
19171	U'	425	50	MAP	CNM85
19280	L'	425	74	UN	4UZ
19395	U	425	50	JIJI	
19525	L	425	50	CETEKA	OLD4
19565	L'	425	50	ANA	
19818	U'	85	50M	AP/UPI	AFRTS
19825	L	425	50	OANA	
19865	U'	425	74	TANJUG	YZJ4
19975	U	425	50	LPS	
19981	U	425	50	PARS	
20008	U'	425	50	BuKTAR	
20080	L'	425	50	AFP	
20085	L'	425	50	ANSA	ISX20
20100	L	425	50	REUTER	
20105	L'	425	50	DIPLO	HSF212
20110	L	425	50	AFP	
20152	U	85	50M	AP/UPI	AFRTS
20155	L'	425	50	KUNA	
20204	U	425	50	TANJUG	YZJ
20312	L'	425	50	AFP	
20386	U'	425	50	REUTER	
20420	L'	425	50	ADN	Y2V20A
20421	L'	425	50	ADN	
20430	L'	425	50	ANSA	IRS24
20483	L'	425	74	VOA	PRS
20494	U	425	50	PAP	SOV249
20506	U	425	50	KUNA	
20559	U'	425	50	JANA	
20625	U'	85	50M	AP/UPI	AFRTS
20728	L'	425	50	ANSA	IRS27
20776	U'	425	50	INDINFO	
20804	U	425	50	KUNA	
20837	U	85	50M	AP/UPI	AFRTS
21784	L'	425	50	KUNA	
21787	U'	425	50	KUNA	
21801	L	85	74	VOA	VOA
21839	U	425	50	TASS	
22760	U'	425	50	AP	DZK79
22781	U	425	50	TASS	RDD73
22782	L'	425	74	ARF	WFN62
22790	U'	425	50	TASS	
22813	L'	425	50	ADN	Y2V29
22885	L'	425	50	ADN	
22909	U	425	50	KUNA	
22918	U'	85	50M	AP/UPI	AFRTS
22955	L	425	50	ANSA	
23315	U'	85	50M	AP/UPI	AFRTS
23499	U'	85	50M	AP/UPI	AFRTS
23542	U'	425	50	REUTER	GLF43
23751	L	425	50	AFP	
23770	L'	425	74	ARF	WFG93
24029	U'	85	50M	AP/UPI	AFRTS
24089	U	85	50M	AP/UPI	AFRTS
24790	L	425	50	ANSA	ISX24
25377	L'	425	50	ANSA	IRX23

Table 1.

ther the original WordPak nor the newer WordPak II will be produced any longer, and that "owners of WordPaks, WordPak IIs, and WordPak-RSs should contact the individual software houses with respect to specific applications software."

While there will be updated drivers to install older WordPaks and PC-Paks into newer systems, "there will be no driver module or update for the 2SP-Pak. The reason for this is that the driver is built into OS-9 Ver. 2.00.00."

I cannot speak as to any of the new drivers; I have yet to see any of them myself. I am aware of several posted in the data libraries of CompuServe but have not looked at those yet, either. If you are a user of one or more of these boards, you might want to drop PBJ a line at their new address, 503 East 40th Street, Paterson NJ 07504, attention Mr. Donald Beane. Be sure to tell him you are interested in the information printed in this column.

Hardly a month goes by that one ham or another does not write me and request information on press wireless frequencies that can be copied on RTTY. Often, my response has been a reference to one of the several books on the market that provide extensive lists of such frequencies. This time is different. Thanks to Scott, the sysop of CompuServe's HamNet, Table 1 is a rather extensive list of some of the signals he has logged over the last few years. This list is from personal monitoring over the last 10 years and is not copied from any other lists. These press stations all transmit in English—some all the time, others just occasionally.

In the table, the "SB" column indicates USB or LSB to be selected for normal copy. The apostrophe next to the L or U indicates that the station is still on the air as of the beginning of last year.

The "SH" column indicates the shift (Mark-to-Space frequency difference) used. Note that most use 425-Hz shift.

The "BD" column indicates the baud rate, not words per minute. This is standard Baudot RTTY code. Most foreign stations use "FIGS J" as the bell and "FIGS S" as the apostrophe, which is the reverse of American machines.

The "M" in the BD column indicates that the station is a frequency-division multiplex (FDM) transmission, usually with 16 subcarriers. The shift is usually 85 Hz, and many terminal units will not copy this. Receiving these FDM stations with the bfo off sounds like a buzz-saw. These stations are the best source of AP/UPI news, quite similar in format to the wire-line press service sent to radio stations. The best way to tune these in is to select USB and tune onto the station from the high-frequency side to the uppermost subcarrier. This subcarrier is usually the one carrying the news.

The "SVC" column shows the abbreviation of the news service.

The "CALL" column is obvious. Not all stations give identify with a callsign. Some use the same callsign on all frequencies at once, and some have calls for each frequency in use, but do not indicate which call is for which transmitter.

Not all stations of a particular service carry the same text. The VOA, for example, carries as many as four different "programs" at the same time. The ARF, however, has the same text on all four frequencies at once.

I have not given times of transmissions. That is too difficult to pin down accurately. Many stations are on continuously.

The frequencies given are within 2 kHz. Some stations do slide up or down a little and reverse their mark and space frequencies on occasion. My receiver readout also does not include the amount of bfo offset (about 1.5 kHz).

Happy tuning. . . de K9EUI!

Now, if all of my stateside readers will forgive me, let me stay overseas for awhile. Jose Vargas HP1XJZ has been trying to get onto RTTY from Panama City, Panama, with his friend Peter HP1XPM. He has a few questions about specific items of equipment advertised for RTTY and packet interfacing. I know I have said this before, Jose, but I try to print whatever information I receive. If you have not seen a particular piece of gear mentioned here, it is because I have not received anything—not personal experience, users' input, or even a manufacturer's blurb—on that item. I try not to review from ads. Check through some back issues and see if what you're looking for is not there; be sure to let the manufacturers know that you would appreciate reading about their products in RTTY Loop before plunking down hard-earned money.

Bill Pearson writes from Upper Hutt, New Zealand, (I have a dermatologist friend by that name, who happens to be a ham as well, here in the Baltimore area) asking about several RTTY programs for the Apple II+ computer. I mentioned the new source for one of them, SuperRATT, a few months back but have heard nothing about the so-called "Galfo" program. He relates that one of the difficulties he faces is that a program which costs $140 here sells for NZ$280 there, and he has to pay for it before even seeing if he likes the way it works. Anybody around willing to stick a hand out and help a brother on the other side of the world?

Another reader in yet another corner of the globe is Gilbert Marazzini in Milan, Italy. Gilbert relates his enjoyment with the materials presented in this column and appears to be interested in learning more about some of the RTTY basics. Don't go anywhere else, Gilbert, there will be more to come, right here.

Dr. Girish Shah, in Ahmedabad, India, has been trying to put a C-64 computer onto RTTY, and it seems that this column and the magazine that contains it are about the only sources for RTTY information available to him. I do hope that some of the material presented here over the last few months has helped, and I look forward to hearing about your success on the Green Keys.

"Green Keys." I wonder how many of you newcomers know where that one comes from? I think I'll just let it dangle for now.

Another Apple user in another land is Geoff Dover G4AFJ in Leicestershire, England. I am sending Geoff the current reprint list, at his request, which details some of the materials gleaned from past columns. The list can be yours, as well; just send a me a self-addressed, stamped envelope to the address at the head of this column and ask for the current reprint list. Naturally, other comments, questions, and prods are welcome at the same time.

The last ham on this whirlwind trip around the world is Alex Deligiannis SV8QG in Chios, Greece. Alex is the proud owner of a CoCo and believes he is the only one in SV-land trying to put one on the air. Well, again, I hope that some of the material I have presented here helps. I have planned some specific programming help for the CoCo if there is sufficient interest. With the paucity of programs comparable to those on other systems, there should be some demand here for a CoCo RTTY program that would be able to access disk functions and have a few bells and whistles to boot. Let me hear all of your opinions.

Now, take a deep breath folks and hear this. This month begins the *tenth year* of this column in *73* Magazine! That's right, TEN YEARS! Wow! I do want to take a moment to thank Wayne Green, without whose foresight many of the developments we take for granted might not have come to pass and who helped me get this column started—back in the dark ages. And my sincere thanks to each and every one of you, the readers of *73*, who have pushed our hobby to the technological limit, then broken even that limit, only to push ahead to a new future.

AA	Turkey press	KCNA	N. Korea press
AAP	Australian press	KUNA	Kuwait press
ADN	E. German press (DDR)	KYODO	Japan press
AFP	French press	LPS	London Press Svc
AFRTS	U.S. Armed Forces	MAP	African press
AGER	Rumanian press	MENA	Egypt press
ANA	Yemen press	MFA	E. German diplo
ANGOP	Angolan press	MINREX	Cuban embassy
ANS	Argentine press	MON	Mongolian press
ANSA	Italian press	MTI	Hungary press
ANT	Indonesia press	NA	Argentina press
AP	Associated Press	NSF	Nat. Science Found.
APA	Austrian press	PAP	Polish press
APN	USSR press	PET	Jordan press
APS	Algerian press	PL	Latin Press (Cuba)
ARF	U.S. State Dept.	PTI	India press
ATA	Albanian press	REUTER	British press
AZAP	Zaire press	SANA	Syrian press
BAK	USSR press	SAP	Algerian press
BTA	Bulgarian press	SLBC	Sri Lanka press
CETEKA	Czech. press	SPA	Saudi press
CNA	China press	SUNA	Sudan press
DIPLO	diplo/embassy	TANJUG	Yugoslavia press
DPA	W. German press (FRG)	TAP	Tunisia press
DYN	Argentina press	TASS	USSR press
EFE	European file	TELAM	Argentina
FRC	Firestone Co.	U.N.	United Nations
GNA	Ghana press	UPI	United Press Int'l.
IINA	Italian press	USCG	Coast Guard
INA	Iraq press	VENPRES	Venezuela press
INDINFO	India press	VNA	Vietnam press
IRNA	Iran press	VOA	Voice of America
JANA	Libya press	WX	Weather
JIJI	Japan press	XINHUA	China press
JNA	Jordan press	YONHAP	S. Korea press
JUEGOS	Latin America	ZANA	Zambia press

Table 2. SVC abbreviations.

As always, I remain available to you, either by mail at the address at the top of the column or on CompuServe, with my user number 75036,2501. If you want to get to me on CIS, EasyPlex (E-mail) is the best way. Messages left on HamNet or the CoCo or OS-9 SIGs may get to me as well, but they depend on my being there to see them before they scroll off the system. Remember, for those of you who send questions via the USPS, a self-addressed, stamped envelope is required if you would like a personal reply; otherwise, watch the column for a reply. Don't forget that I write each column about two to three months before you see it, though.

Summer's coming, with Field Day, picnics, and swimming parties. Who's going to be the first with a terminal at poolside? Send me a picture, then look for it in next winter's RTTY Loop!■

NK6K > PACKET

Harold Price NK6K
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Redondo Beach CA 90278

COMING ATTRACTION

Wake the kids and call the neighbors. The August issue of *73* is going to be all packet! And no, it won't just be this column with a thyroid condition. Nine or ten packet people will address such topics as: Intro to Packet, Intro to Networking, Better HF Operations, Packet Common Sense Operating Guide, Packet in Space, How to maintain digipeaters up where the air is thin, How to be a bulletin board/mailbox sysop, and more. For those of you who are worried that the inmates have finally taken over the asylum, don't worry; *73* will return to its regular fare the next month.

Packet Basics

For this section, I take as my text *73* Magazine, April 1986, page 82, RTTY Loop column. I'll review the question "What does packet provide to justify the cost?" and touch on some of the differences between RTTY, AMTOR, and packet. We know that packet is used to move characters between ham stations—something RTTY and AMTOR already do. What makes packet different?

Digression one. It is not my goal here to rate one mode over the other. Comparing the three modes is a bit like comparing apples to oranges to pears anyway. Each was designed for a different purpose—to solve different problems at widely separated points in history. More importantly, the actual implementation of each mode by the hardware and software in whatever device you've chosen to use can have a far greater effect on performance than the mode itself. A poorly implemented version of AMTOR software, or a packet controller with an inferior modem, will result in less data, or more bad data, than a well executed RTTY package.

Digression two. If you like using RTTY, don't let anyone talk you out of using it just because he says the mode is outdated. Whether it is or isn't is not the point, and that topic will not be debated here. Even though many in the RTTY world have changed over to the quiet tube-based RTTY systems, people still like using the old moving-parts gear for the challenge of bringing it up and keeping it running. The RTTY Loop column still carries information on how to get vintage electromechanical teleprinters on the air. If it's fun, I'm all for it. Some folks like whirring gears, others like flashing lights. While Part 97 tells us to provide emergency communications, extend the radio art, improve our skills, and enhance international goodwill, nowhere does it say that we can't have a good time doing it.

Recall the question "What *does* packet provide, and what is the cost?" Let's look at the easy part first: What does it cost? To get an idea of what the RTTY-experienced ham would consider cost-effective, I went to see my friend Lee Hallin WB7SND. He has managed to stay single and hasn't been forced to throw away things he'd rather save. His archives of *73*, therefore, are much larger than mine. We went back to the issue containing the first appearance of the RTTY Loop column, June 1977. This was a time when computer-based RTTY was just gathering steam. I'll compare RTTY prices in that year to the price of getting on packet in the year that this packet column first appeared, when packet was beginning to gather momentum. In the June 1977 issue, I found two references to the price of RTTY gear. The column intro said, "a complete RTTY station can be assembled for under $100." An ad near the middle had recently new TTY-33s (usable on RTTY by the strong-willed) for $850. Comparing the purchasing power of the dollar between 1977 and June 1985 (I got this data from the 1986 *World Almanac and Book of Facts*, page 51, the closest I could find in '86), you'd need at least $158 in 1985 money to equal $100 in 1977; $850 in 1977 is $1347 now.

Can you get on packet for $158 now? Sure can! A $50 surplus Xerox 820 board, a $10 keyboard, a $15 monitor, a FAD board from TAPR, the FADPAD software from FADCA, a $20 surplus modem, and you're on the air. In 1986, this is known as "the hard way." There are several complete TNC kits available in the $160 range. Put it together, plug it into the computer you probably already have, and you're on the air. Don't have a computer? Check the next swap meet; you should be able to pick up a glass-TTY (dumb terminal) for way under $100. Commodore C-64s are around $99. Don't like kits? Some assembled and tested TNCs are only $30 more.

If you already have a C-64, $219 gets you CW/RTTY/AMTOR *and* packet with AEA's PK-64 (reviewed in February's *73*). That's $129 in 1977 money. The same price or less gets you a packet-only unit that will work with any computer that draws less than 30 mA. You can run your TNC from the same 9-volt cell that you use to run your flashing LED callsign badge. A manufacturer new to the packet market has been advertising an assembled and tested packet controller for a price in the low hundred dollar range, but since I haven't seen one yet (3/31/86), I can't comment on it.

The price for a good packet unit and the price of a good RTTY or AMTOR unit are about the same. Depending on the features you can live without and how hard you are willing to work to scrounge parts, packet can be had for less than $158. Note that the above discussion, like the one in 1977, assumes you already have a radio. Just as RTTY would soon boom after 1977, packet is in a rapid growth phase now. Expect to see minimum featured TNCs available for less than $100 soon, while TNCs with more features will be in the $150 to $300 price range. All of the prices mentioned here may be different by the time you see this, so check around.

Now to the more interesting part of the question, "What does packet provide?" Last month's column gave references to technical information on what packet provides. This month, I'll discuss some of the major obvious features the operator sees.

The most obvious differences stem from "packetizing," breaking up your data into chunks. Packet controllers (TNCs) move your data around in chunks of 80 to 128 characters on the average. This process goes on in the background. In most cases, you need not be aware that it is happening; you just keep feeding characters to the TNC.

There are several methods you can use to control the packetizing process. One way is by the use of a special character that tells your TNC to take up all of the characters you've entered to that point and make them into a packet. The special end-of-packet character can be specified by the user (with a command called SENDPAC on TAPR-like TNCs). Most users select the return key, <cr>. This causes a packet to be sent each time you hit <cr> as you type. A second way is to specify a maximum length for a packet (PACLEN). The best length to pick depends on several factors—the mode (HF, VHF, OSCAR 10), the number of digipeaters you're using, the load on the channel, the signal strength, etc. When you have entered the specified number of characters, a packet will be sent. A third way is based on time. You can tell your TNC to send a packet every "n" seconds or after you have stopped typing for "n" seconds. You can use these three methods in any combination on most TNCs.

The end effect is that you just type on your keyboard, and the TNC takes care of sending the packets. Because of the packet-

ization process, there is always an occasional gap in your transmissions on the air. During these gaps, packets from the other station can be received. You can choose to see characters from the other station as soon as they are received, although most people use the FLOW ON command to get the TNC to hold characters from the other station until you have entered a complete line. What you then see on the screen are lines that you have entered interspersed with lines transmitted from the other station.

At least one TNC automatically performs a split-screen function. This gives you maximum flexibility in how you want to conduct your conversations. You can still talk in a paragraph mode, in which you finish a complete thought before the other station begins to respond. Or, you can rapidly trade short comments without having to make sure that the other station has dropped its carrier before you turn yours on and without having to use procedural signals such as OVER, K, AR, BK, or SO HW CPY OM. The TNC is taking care of that automatically. Full break-in RTTY is a joy to operate. We've all sat helplessly as a three-minute 60-wpm transmission has come in, answering a question we didn't ask. Packet gives you the opportunity to say, "Wait, you misunderstood the question."

A second benefit of packetization is more positive control over computer bulletin board systems (BBS). If you're an active RTTY mailbox user, how many times have you accidentally initiated a far longer dump from a mailbox than you intended? RTTY mailboxes can't hear while they're transmitting. A packet BBS can, once every 128 characters or so. You can write RTTY software that will turn off the transmitter and listen for a "go ahead" command, but that takes more software and will slow down someone who is getting what he asked for.

The third benefit of packetization I'll discuss this month is channel sharing. Digital devices can send characters faster than most hams can type. Whether you're sending on RTTY at 60 to 100 wpm or on packet at 360, 1,440, or more wpm, you can't keep the pipe full by hand, and sooner or later your type-ahead buffer runs dry. On RTTY and AMTOR, dead space between entered characters is filled with idles, diddles, or straight tone. The frequency is "in use" even though no useful information is being sent. If your typing speed is 30 wpm and the channel speed is 60 wpm, 50% of the channel time is being wasted.

On packet, all characters are queued up in the TNC until a packet is sent. Only then does your station go on the air. If your typing speed is 30 wpm and the channel speed is 1,440 wpm, your station will only be on the air 2% of the time, or actually closer to 4% counting overhead. This leaves 96% of the channel free for other conversations, even though you are "using the frequency." Thus, there is room for 24 other 30-wpm typists on the same channel at the same time. Federal law requires me to tell you that, just as with EPA mileage, your rates may differ. The mechanics of sharing the channel tend to eat up some of the time. Future columns will discuss this matter in detail. To answer the first question that always comes up when channel sharing is discussed, your TNC takes care of showing you only those packets being sent to you. But yes, you can choose to see packets that aren't directed at you (reading the mail), and yes, there is a way to send CO.

So, there we have three things packet provides that have nothing to do with linked digipeaters or error-free communications. I'll name a few more and save detailed discussion for future months.

Packet uses the full 8-bit ASCII character set. That means you can use all of the special characters, as well as lowercase. This tends to make conversations more expressive, since shouting is usually done in uppercase, LIKE THIS. As a more practical matter, it also makes connecting computers to radio easier, since you don't have to worry about mapping a 7- or 8-bit code set to a 5-bit one. You can use the control-C character to abort a message in progress on BBS systems, for instance. It is easy to connect other computer-based devices to packet, such as SSTV converters, because the TNC is taking care of all of the communications aspects.

Packetization makes nondirected round-tables possible. That's where everyone on the channel talks to everybody all at once, as in a Dayton hospitality suite. A duplex packet repeater is used for that purpose out here, and until you've actually taken part in a 28-way simultaneous conversation, you won't understand why you'd want to.

One last thing for this month that packet provides: fun. As I was writing this, Utah hams were putting up a new digipeater or two so that it was possible to get to Salt Lake City from southern California. One of the southern California packeteers, AA6TN, was having such a good time he didn't know which to do, work Utah or contact other local hams to let them know what was happening. He used packet to Utah with one hand and passed the news on a local voice repeater with the other. Although an eight-digipeater path is tenuous, it does establish future networking sites. The hard part of a nationwide VHF network is getting all the antennas, radio, TNCs, and Forest Service permits in place. Once the hardware is running, software improvements like those announced at the Orlando conference in March will provide the solid performance that packet promises.

Orlando

The 5th Amateur Radio Computer Networking Conference, sponsored by the ARRL, was held in Orlando, Florida in March. These conferences attract hams from all over North America and abroad to discuss packet radio issues and plan for the future. They are scheduled at roughly one-year intervals and usually trade coasts each year. During the conference, there were several demonstrations of software that will provide the next level of network linking. These "smart digipeaters" will spring up like wildfire as soon as final testing is complete. As is usual, there is more than one way to skin a cat. Two different methods of networking were shown, and each method had a camp of loyal followers. The whole topic of networking will be discussed in an article in the August issue of *73*, so reserve your copy now. The technical papers that were presented at the conference have been bound and published by the ARRL and are available from the League, as are the Proceedings of the 5th Networking Conference.

Up To Date News

Due to the publication delays in large magazines, you won't see many news-breaking items here first. I'll try to provide background and commentary for major news items, though. The job of this column is to take a more leisurely look at things, to answer your questions, and to fill in the gaps. There are several excellent ways to keep track of the fast-moving world of packet as things happen, however.

The best way is to take the plunge and get on packet. Even if you primarily want to ragchew, the various BBS systems in your area carry the latest news. One of the newsletters you usually find on packet BBS systems is the *GATEWAY* newsletter. The ARRL publishes this newsletter every two weeks and permits the reproduction and dissemination of the information on packet systems. The newsletter is also available by subscription. If you do read it on a packet system, please drop them a line to let them know so they can continue to justify the expense of releasing it "for free." Another way to get current information is via CompuServe's HAMNET. This will cost you some bucks, but most of the news and technical information finds its way to HAMNET sooner or later. I'm on HAMNET, and so are the Funl and RTTY Loop columnists and the *73* Editor, but don't let that dissuade you.

For international packet users, as well as local folks, the UoSat-OSCAR-9 and UoSat-OSCAR-11 spacecraft carry plain-text ASCII bulletins that include major packet news. A future column will contain information on how to copy the digital satellites. I have at least a year's backlog of things to talk about, so I hope no one catches me having a good time and shuts me down before then. The AMSAT publications provide satellite information. Ask an AMSAT member for a peek at his back issues, or better yet, become a member yourself. There will be two packet-related amateur satellite launches this year.

That's all for this month, next month I'll discuss FCC RM 85-105, the automatic control order, plans for an STA request for automatic control of HF store-and-forward message systems, and the Dayton packet activities. Until then, see you on packet. ■

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough, NH 03458-1194.

PICCOLO SPOLETO FESTIVAL
MAY 24–JUN 7

The Trident ARC will operate N4EE to commemorate the Piccolo Spoleto Festival's ninth season of presenting local and southeastern regional talent from every artistic discipline, as follows: 1400 UTC to 2400 UTC on May 24–25, May 31–June 1, and June 7. SSB—7.249, 14.240, 21.340, and 28.540; CW—7.120 and 21.120. Certificate for QSL and large SASE to TARA, PO Box 73, Summerville SC 29484–0073.

BLOSVALE NY
JUN 1

The Rome (New York) Radio Club, Inc., will sponsor its 34th annual Ham Family Day on June 1, beginning at 9 a.m., at Becks Grove, Blosvale, New York. Talk-in on 146.28/.88 and 146.34/.94. For more information or for reservations, write the Rome Radio Club, Inc., Box 721, Rome NY 13440, or call William Effland at (315)-853-5700.

HUMBOLDT TN
JUN 1

The Humboldt ARC will sponsor its annual hamfest on Sunday, June 1, at Bailey Park, 22nd Avenue, Humboldt, from 8 a.m. to 4 p.m. Admission is $1. Talk-in on .37/.97. For further information, contact Ed Holmes W4IGW, 501 N. 18th Avenue, Humboldt TN 38343.

CHELSEA MI
JUN 1

The Chelsea Communications Club will sponsor its ninth annual Swap 'N' Shop on June 1, from 8 a.m. to 2 p.m., at the Chelsea Fairgrounds, Chelsea, Michigan. Admission is $2.50 in advance and $3 at the door. YLs, XYLs, and kids under 12 are free. Table space (8 feet) is $8; trunk sale space is $2. Talk-in on 147.255. For more information, call (517)-764-5785, or write William Altenberndt, 3132 Timberline, Jackson MI 49201.

MILESTONES OF MEMORIES
JUN 6–8

The Wichita (Kansas) ARC will operate special-event station WØ SOE from Lewis, Kansas, on June 6–8 to help celebrate its centennial. The Milestones of Memories operation will be on approximately 3.875, 7.250, 14.250, and 21.325 MHz. QSL via WØSOE, Wichita ARC, 707 N. Main, Wichita KS 67203.

LIGHTSHIP PORTSMOUTH
JUN 6–8

The Portsmouth (Virginia) ARC will operate W4POX on June 6–8, 1500–0800 UTC daily, from the Lightship Portsmouth at the Portsmouth Seawall Festival. Frequencies are 7.230 and 14.290. For a commemorative QSL, send a QSL and an SASE to W4POX, 4800 Manor Avenue, Portsmouth VA 23703. For a QSL and a certificate, send your card and a 9 x 12 envelope with 44 cents postage.

GUELPH ONT
JUN 7

The Kitchener-Waterloo ARC will sponsor the 12th annual Central Ontario Amateur Radio Flea Market and Computerfest on Saturday, June 7, from 8 a.m. to 2 p.m., at the Col. John McRae Legion Hall, Guelph, Ontario. Admission is $2. Inside space is $8 (table included). Outside space is $3. Talk-in on 147.960/.360 and .52. For more information, write the Kitchener-Waterloo ARC, PO Box 812, Kitchener, Ontario, Canada N2J 4C2, or call Paul VE3CHM at (519)-579-3057.

NORTH GEORGIA
JUN 7

The John Ross ARC will sponsor the fourth annual North Georgia Hamfest on Saturday, June 7, beginning at 8 a.m., at Lakeview Fort Oglethorpe High School, five miles south of Chattanooga, Tennessee. Admission is $1; flea-market spaces are $6; tailgating spaces are $2. Exams will be given. For more information, write the John Ross ARC, PO Box 853, Rossville GA 30741, or call Murel Winans KA4LMG at (404)-867-7739.

ST. PAUL MN
JUN 7–8

The North Area Repeater Association will sponsor its Amateur Fair on the weekend of June 7 and 8 at the Minnesota State Fairgrounds in St. Paul, Minnesota. Admission is $4 in advance or $5 at the Fair. Amateur license exams will be given. Giant outdoor flea market, exhibits, commercial dealers. Free overnight parking June 6 and 7 for self-contained campers. Talk-in on .25/.85 or .16/.76 repeaters. For dealer inquiries, tickets, and further information, write Amateur Fair, PO Box 857, Hopkins MN 55343, or call (612)-566-4000.

OHIO WINE MONTH
JUN 7–8

WINO (Wireless Institute of Northern Ohio), an organization sponsored by the Lake County Amateur Radio Association, will be on the air from a winery in Madison, Ohio, with the call KO8O, to commemorate Ohio Wine Month. Operation will be on 3.860 and 7.235 from 2300 UTC to 0300 UTC, Saturday, June 7, and on 7.235 and 14.235 from 1500 UTC to 1900 UTC on Sunday. For a special 8-1/2 x 11 certificate, send a legal-size SASE to KO8O WINO Weekend, 7126 Andover Drive, Mentor OH 44060.

25TH ANNIVERSARY
FAIR LAWN NJ ARC
JUN 7–8

The Fair Lawn ARC will operate the club station under founding member Frank Leonard's call, W2NPT, to commemorate the 25th anniversary of the club. Operation will be from 1300 to 2200 UTC on the 7th and from 1400 to 1500 UTC on the 8th. Frequencies: CW—7.050, 7.110, 14.050, and 21.050 (±10 kHz); phone—7.285, 14.285, and 21.385 (±10 kHz). For a certificate, send a QSL and an SASE to Frank Leonard W2NPT, 17–12 Well Drive, Fair Lawn NJ 07410.

LOVELAND CO
JUN 7–8

The Northern Colorado ARC will sponsor Superfest VIII on June 7–8, beginning at 9 a.m., at the Larimer County Fairgrounds, Loveland, Colorado. Admission is $3; tables are $5; tailgating is $5. For more information, contact Cliff Baker WØITD, 2623 52nd Avenue, Greeley CO 80634; (303)-330-3548.

ERLANGER KY
JUN 7–8

The Northern Kentucky ARC will sponsor Ham-O-Rama '86 on June 7–8, beginning at 8 a.m., at the Best Western Vegas Convention Center, Erlanger, Kentucky. Admission for both days is $5; children under 13 are free. Indoor and outdoor flea market—contact AF4Y or WD4PBF at the gate for spaces and prices. Talk-in on 147.855/.255. For more information, call Joe Dunnett WA4WNF at (606)-371-2255 or write NKARC at PO Box 1062, Covington KY 41012.

SJRA 70TH
JUN 7–16

The South Jersey Radio Association, the oldest radio club in the U.S., will operate special-event station K2AA from 1200 UTC on June 7 until 1200 UTC on June 16 in celebration of the club's 70th birthday. Frequencies: phone—3.890, 7.240, 14.280, 21.360, 28.600; CW—3.590, 7.050, 14.050, 21.090, 28.150; two meters; Novice bands. For a commemorative QSL, send an SASE and a QSL (or log Info) to the South Jersey Radio Association, PO Box 1026, Haddonfield NJ 08033.

LEWISBURG PA
JUN 8

The Milton ARC will hold its 12th annual hamfest on Sunday, June 8, from 8 a.m. to 4 p.m., at the Winfield Firemen's Fairground, four miles south of Lewisburg, Pennsylvania. Admission is $3; women and children are free. Talk-in on 146.37/.97 or 146.025/.625. For more information, contact Jerry Williamson WA3SXQ, 10 Old Farm Lane, Milton PA 17847; (717)-742-3027.

ROANOKE VOYAGES
JUN 8, 10

The Raleigh Amateur Society, in conjunction with the hams of North Carolina and in cooperation with the North Carolina State Department of Cultural Resources, will celebrate the 400th anniversary of Sir Walter Raleigh's Roanoke Voyages by operating special-event station W4DW. Operation will be on 3.905, 7.250,

and 14.335 MHz (±QRM) from 1500 to 2100 UTC on both Sunday, June 8, and Tuesday, June 10. For a commemorative QSL card and historic literature, send your QSL card and a #10 SASE to W4DW RARS, PO Box 17124, Raleigh NC 27619. Your card and our logs will become a permanent part of the log of *Elizabeth II*, a sailing replica of the original craft.

QUEENS NY
JUN 8

The Hall of Science ARC will sponsor a hamfest on June 8, from 9 a.m. to 4 p.m., at the Hall of Science Parking Lot, Flushing Meadow Park, 47-01 111th Street, Corona, Queens, New York. Admission is $3 for buyers; $5 for sellers. Talk-in on 144.300 simplex link, 223.600 repeat, and 445.225 repeat. For more information, call John Powers KA2AHJ at (718)-847-8007, or Arnie Schiffman WB2YXB at (718)-343-0172.

GRANITE CITY IL
JUN 8

The Egyptian Radio Club will hold its 57th annual hamfest on Sunday, June 8, from 8 a.m. to 3 p.m., at the ERC clubhouse and grounds. Admission is $1 in advance; $2 at the door. The first flea-market space is free; each additional space is $5. Directions: I-270 to IL Route 3 South, turn right at Chain of Rocks Road, then follow signs. Talk-in on 146.16/.76 or 146.52. For tickets or more information, send an SASE to the Egyptian Radio Club, PO Box 562, Granite City IL 62040.

DREXEL HILL PA
JUN 8

The Delaware County ARA will sponsor its seventh annual hamfest on June 8, beginning at 8 a.m., at the Drexel Hill Middle School, Drexel Hill PA. Admission is $3. Indoor tables with power are $3; outside tailgating is free. Exams will be given. Talk-in on 147.96/.36, 224.5, and 146.52. For more information, write to Hamfest, DCARA, PO Box 236, Springfield PA 19064, or call Barbara N3DLG at (215)-535-1616.

NEWINGTON CT
JUN 8

The Newington ARL will hold its third annual flea market on Sunday, June 8, from 9 a.m. to 2 p.m., at Newington High School, Willard Avenue (Route 173), Newington, Connecticut. Admission is $2. Tables are $10; tailgating is $5. Talk-in on 146.52, 144.85/145.45, and 223.24/224.84. For more information, send an SASE to Les Andrew KA1KRP, 23 Grove Street, West Hartford CT 06110; (203)-523-0453.

WRIGHTSTOWN PA
JUN 8

The Warminster ARC will sponsor its 12th annual hamfest on Sunday, June 8, beginning at 7 a.m., at the Middletown Grange Fairgrounds, Penns Park Road, Wrightstown, Pennsylvania. Admission is $3; XYLs and children are free. Outdoor tailgating spaces are $5; indoor spaces with 8-foot table and power are $5 (pre-registration suggested). Talk-in on 147.69/.09 and 146.52. For information or pre-registration, contact Chuck Dunn KA3FQQ, 1414 Bradley Lane, Warminster PA 18974; (215)674-8567.

LOUSIVILLE KY
JUN 11–14

The Antique Radio Club of America will hold its annual national convention on June 11–14 in Louisville, Kentucky. All interested people are invited. ARCA has about 1000 members who collect and restore antique wireless and radio equipment and who study and record the history of early radio. For more information on the convention or ARCA membership, contact ARCA, 81 Steeplechase Road, Devon PA 19333; (215)-688-2976.

CORTLAND NY
JUN 14

The Skyline ARC will sponsor a hamfest and flea market on Saturday, June 14, from 8 a.m. to 5 p.m., at the Cortland County Fairgrounds, Cortland, New York. Admission is $3; under 12 free. Outdoor flea-market space is $1; an indoor table is $5. For more information, call Billy N2AGF at (607)-749-3766, or Bud K2ZER at (607)-753-3994.

BSA SCOUT-O-RAMA
JUN 14

The Chicago Suburban Radio Association will operate its third annual special-event amateur-radio station, N9BAT, from the Brookfield Zoo, Brookfield, Illinois, on June 14, from 1500 to 2300 UTC, as part of the West Suburban Council, BSA, annual Scout-O-Rama. Frequencies: 7.250 and 14.250 MHz. A special full-color QSL card available for a QSL card and business-size SASE to N9BAT Special Event, PO Box 88, Lyons IL 60534.

TWIN FALLS ID
JUN 14–15

The Magic Valley Chapter of the Idaho Society of Radio Amateurs will sponsor a swap meet on June 14–15, from 10 a.m. to 5 p.m. on Saturday and from 8 a.m. to 12 noon on Sunday, at the Moose Lodge, 835 Falls Avenue, Twin Falls, Idaho. Admission is free. Talk-in on 146.16/.76. For more information, write the Idaho Society of Radio Amateurs, Magic Valley Chapter, PO Box 294, Twin Falls ID 83303.

CROWN POINT IN
JUN 15

The Lake County ARC will sponsor its 14th annual Fathers' Day Hamfest on Sunday, June 15, from 8 a.m. to 2 p.m., at the Lake County Fairgrounds Industrial Building, Crown Point, Indiana. Admission is $3. Tables will be available. Talk-in on 147.84/.24 or 146.52. For more information, write Bill DeGeer W9TY, 3601 Tyler Street, Gary IN 46408, or call (219)-887-5413 after 6 p.m.

FREDERICK MD
JUN 15

The Frederick ARC will hold its 9th annual hamfest on June 15, from 8 a.m. to 4 p.m., at the Frederick Fairgrounds, Frederick, Maryland. (Gates open for ex-

SATELLITES

USING THE A0-10 PREDICTIONS

Apogee predictions for the month of June are provided for three sections of the United States: Washington, D.C.; Denver, Colorado; and Los Angeles, California. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
June 1986

		WASH		DENVER		LA	
DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1	1301	172	19	146	10	134	7
2	1220	163	18	138	6	128	2
3	1139	154	15	131	1		
4	1058	145	11				
5	1017	138	6				
6	0936	131	1				
8	1954					234	1
9	1913					228	6
10	1832			230	1	221	11
11	1751			223	5	213	16
12	1710			215	10	204	21
13	1629	230	1	207	14	195	24
14	1549	223	6	198	17	185	25
15	1508	215	11	188	18	174	25
16	1427	207	15	179	19	164	23
17	1346	198	18	169	18	155	21
18	1305	188	20	160	16	146	17
19	1224	178	21	151	14	138	12
20	1143	169	19	142	9	131	6
21	1102	159	17	135	5	125	0
22	1021	150	14	128	0		
23	0940	142	10				
24	0859	134	5				
25	0818	127	0				
27	1836					233	3
28	1755					226	9
29	1714			228	3	219	14
30	1633			221	8	211	19

hibitors at 8 p.m. on the 14th. Overnight security and parking provided.) Admission is $3, tailgaters $2 additional; exhibitor tables are $10 for the first, $5 for each additional table. YLs and children admitted free. For additional information, write Jim Kasunic KA3LPC, 9419 Highlander Court, Walkersville MD 21793.

DUNELLEN NJ
JUN 21

The Raritan Valley Radio Club will hold its 15th annual hamfest on Saturday, June 21, beginning at 8 a.m., at Columbia Park, Dunellen, New Jersey. Admission is $3; spouses and children are free. One selling space is $5; $10 for multiple spaces. Tables are not supplied. Talk-in on 146.025/.625 and 146.52. For more information, call Dave KA2TSM at (201)-763-4849 or Bill N2AZX at (201) 467-7342.

ARGONNE LAB
JUN 21

The Argonne ARC will operate special-event station W9QVE from 11 a.m. to 4 p.m. CST on June 21 to commemorate the 40th anniversary of the establishment of the U.S. National Laboratory System (Argonne was the first). Operation will be on 144.59/145.19 and the phone portion of the 20-meter General band. Send a QSL and an SASE to AARC, PO Box 275, Argonne IL 60439.

MANCHESTER NH
JUN 21

The New Hampshire FM Association will sponsor an amateur radio/electronics flea market on Saturday, June 21, beginning at 9 a.m., at the Manchester Municipal Airport, Manchester, New Hampshire. The rain date is Sunday, June 22. Admission is $1; $5 for sellers—tables not provided. Talk-in on 146.52 FM. For more information, contact Pete Henriksen WA1RCF, 123 Woodlawn Circle, Portsmouth NH 03801; (603)-431-5432—or call Doug Aiken K1WPM at (603)-622-0831.

TWIN VALLEY 100TH
JUN 27–30

Special-event station KE0DJ will be operated on June 27–30 to commemorate the centennial of Twin Valley, Minnesota. Operation will be primarily on 15, 20, and 40 phone, as well as available satellites. QSL with #10 SASE to KE0DJ, c/o Dale Cary WD0AKO, 1318 34th Avenue S. #301, Moorhead MN 56560.

GRAND RAPIDS MI
JUN 28

The Independent Repeater Association will sponsor its annual IRA Hamfest, "The Amateur Extravaganza," on June 28, from 8 a.m. to 4 p.m., at the 44th Street Armory, Grand Rapids. Admission is $3.50; tables free. Take U.S. 131 south of Grand Rapids to 44th Street and go west 1 mile. Talk-in on 147.765/.165. For table reservations and further information, write the Independent Repeater Association, 562 92nd Street, Byron Center MI 49315, or call Abe W8HVG at (616)-455-3915.

LINCOLN BIRTHPLACE
JUN 28–29

The Lincoln Trail ARC will operate special-event station W4BEJ from the Abraham Lincoln Birthplace National Historic Site near Hodgenville, Kentucky, during Field Day, June 28–29. For a commemorative certificate, send a QSL and an SASE (Note: LTARC log will show only Field Day calls—be sure that you include that information) to LTARC, PO Box 342, Vine Grove KY 40175.

VANCOUVER 100TH/
VARC 50TH
JUN 28–29

The Vancouver ARC is celebrating its home city's centennial and its own 50th anniversary by operating two Field Day stations on June 28–29. In cooperation with the Expo '86 Amateur Radio Committee, the club will operate station VE7 EXPO and station VC 100. Those who contact either station will receive a special QSL.

ACB 50TH
JUN 29–JUL 5

The ACB Radio Amateurs, a special-interest affiliate of the American Council of the Blind, will operate special-event station KW4U from 0000 UTC on June 29 until 2400 UTC on July 5 from the Hilton Hotel in Nashville TN, the sight of the ACB's silver anniversary convention. Operation will be 80 through 10 meters: 30 kHz from the bottom of CW bands; 5 kHz from the bottom of phone bands (±QRM). For a commemorative certificate, send a QSL to John McCann K4WU, 2105 W. Illinois Street, Arlington VA 22205.

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we've decided to go directly to the source—you, the reader. Below, the articles and columns in this issue are assigned numbers. These numbers correspond to those on the "Feedback" card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

"What's in it for me?" comes the cry from our faithful readers. Besides the knowledge that you're helping us find out what you like (and don't like), we'll draw one Feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save some money on stamps, why not fill out the Reader Service card, the Product Report card, and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 22 cents!

Feedback #	Title		
1	A Walk Through the VHF/UHF Spectrum	13	Contests
2	Hams in Space	14	Dealer Directory
3	Two to Ten	15	Fun!
4	Some Guys Make It . . .	16	Letters
5	Digital Simplex Repeaters	17	Looking West
6	Messing With Microwaves	18	Never Say Die
7	They Threw What Away?	19	New Products
8	Those Tantalizing Twos	20	NK6K > Packet
9	Computer Rotor Control	21	Propagation
10	Review: ICOM's IC-471A *versus* Kenwood's TS-811A	22	QRP
		23	QRX
11	Review: The MFJ-1270 TNC	24	RTTY Loop
12	Barter 'N' Buy	25	*73* International

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MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

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INDIVIDUAL PHOTOFACT FOLDERS. #1 to #1400, $3 postpaid. Loeb, 414 Chestnut Lane, East Meadow NY 11554. BNB312

IMRA—International Mission Radio Association. Forty countries, 800 members. Assists missionaries with equipment loaned, weekday net. 14.280 MHz, 2:00–3:00 p.m. Eastern. Brother Bernard Frey, 1 Pryer Manor Road, Larchmont NY 10538. BNB326

ELECTRON TUBES: receiving, transmitting, microwave—all types available. Large inventory means next-day shipment in most cases. Daily Electronics, PO Box 5029, Compton CA 90224; (213)-774-1255. BNB330

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CABLE TV CONVERTERS and equipment. Plans and parts. Build or buy. For information, send SASE to C & D Electronics, PO Box 1402, Dept. 73, Hope AR 71801. BNB383

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XEROX MEMORYWRITER—parts, assemblies, boards, manuals. Free help with service problems. W6NTH, Box 250, Benton AR 72015; (501)-778-0920. BNB404

HAM TRADER YELLOW SHEETS, in our 24th year. Buy, swap, sell ham-radio gear. Published twice a month. Ads quickly circulate—no long wait for results. SASE for sample copy. $10.00 for one year (24 issues). PO Box 2057, Glen Ellyn IL 60138-2057. BNB412

ROHN TOWERS—Wholesale direct to you. 34% discount from the Rohn dealer price. All products available. Also, very low prices on Antenna Specialists antennas and Andrews Heliax. Write or call for catalog and price list. Hill Radio, 2503 G E Road, Bloomington IL 61701-1405; (309)-663-2141. BNB417

DIGITAL AUTOMATIC DISPLAYS for FT-101s, TS-520s, Collins, Swan, and all others. Six 1/2" digits. 5" wide by 1-1/4" high metal cabinet. Send $1.00 for information and receive a $25.00 discount. Be specific. Grand Systems, Dept. A, PO Box 3377, Blaine WA 98230. BNB423

THE RADIO CLUB of Junior High School 22 N.Y.C., Inc., is a nonprofit organization incorporated under the laws of the State of New York with the goal of using the theme of Ham Radio to further and enhance the education of young people. Your equipment donation would be greatly appreciated. WB2JKJ via callbook or telephone (516)-674-4072, 24 hours, seven days a week. THANK YOU. BNB427

QUALITY REPAIRS at very affordable prices. $25/hour. Skylab thanks everyone for their patronage. We have moved to a larger location where we can better serve you. Non-warranty repair on all HF Kenwood, Yaesu, and ICOM equipment. AMP Supply, Ameritron, Dentron, ICOM, Kenwood, and Yaesu amplifiers. Any Heathkit equipment, TV boards, and high-voltage supplies at 20% less than Heath. Most TV monitors, tuners, VHF/UHF, satellite, computers, drives, telephones, CBs. We do modifications and filter installations. 30-day warranty on parts and labor. We fix almost anything! Be sure to file our new address for later reference. Skylab, Inc., 5514 W. Lisbon Ave., Milwaukee WI 53210; (414)-87-12345, 24 hours. BNB428

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KENWOOD 430S OWNERS! Stop Scan stops the scan on busy channels. After they clear, scan continues automatically! Reviewed *73* 2/85. $19.95 (assembled $29.95). Shipping $2.50. JABCO, R1 Box 386, Alexandria IN 46001. BNB438

NEW Spectrum Analyzer/Monitor Receiver kit $60. Send SASE for details. Science Workshop, Box 393, Dept. 73, Bethpage NY 11714. BNB440

MARCO—Medical Amateur Radio Council, Ltd. Operates daily and Sunday nets. Medically oriented amateurs (physicians, dentists, veterinarians, nurses, physio-therapists, lab technicians, etc.) invited to join. Presently over 550 members. For information, write MARCO, Box 73's, Acme PA 15610. BNB441

ATTENTION Kenwood TS-430S, ICOM 745 and 751, Yaesu FT-757GX owners! Modification for general-coverage transmit the right way. Send $3 for each to W. Thomas, PO Box 96, Uniontown PA 15401. BNB445

1986 **"BLOSSOMLAND BLAST"** Sunday, October 5, 1986. Write "BLAST," PO Box 175, St. Joseph MI 49085. BNB446

BRAND NAME 5.25" **FLOPPY DISKS.** Ten disks in polypak: SSDD, $7.99; DSDD, $8.99. Includes sleeves, ID labels, and tabs. Send check or money order to Micro-Applications, Inc., 915 E. Sheridan, Des Moines IA 50316. Add $1.50 for one to five polypaks, $3 for five or more, COD orders add $2; Iowa residents add 4% sales tax. BNB447

YAESU OWNERS—Hundreds of modifications and improvements for your rig. Select the best from 14 years of genuine top-rated Fox-Tango Newsletters by using our new Comprehensive Index. Only $4 postpaid with Rebate Certificate creditable toward Newsletters purchases. Includes famous Fox-Tango Greensheet and Filter information for your rig (if specified). N4ML, FTC, Box 15944, W. Palm Beach FL 33416; (305)-683-9587. BNB448

C-64 AND C-128 SOFTWARE: Send SASE for list. PO Box 387, Chillicothe OH 45601. BNB449

MORSE CODE. Send Wordstar documents as Morse code over computer's internal speaker. SASE for details, $7 for unprotected disk for IBM-PC and compatibles. AA4PG, 478 Cahaba Landings Road, Birmingham AL 35210. BNB450

HEAR! HEAR! INTRODUCING WHIP-IT, the new 1/4-wave whip for your HT with the difference they can hear. So flexible you can tie it in a knot! Single-element design makes it almost indestructible—no sections to loosen or break. Gives you the edge you need to hit those distant repeaters! So WHIP-IT on for camping, emergencies, or just shooting the breeze. Available for 2m or 220 MHz. BNC only. $11.95 plus $2 shipping. No CODs please. NRI Products, PO Box 11501, Reno NV 89510. BNB451

WANTED, MILITARY/COMMERCIAL Collins radio equipment. We need 618T, ARC-94, ARC-102, RT-712/ARC-105, ARC-114, ARC-115, ARC-116, ARC-159, ARC-164, ARC-186, ARN-118, RT-1159A, 718F-1/2, 719A, MRC-95, HF-105, FRC-93, PRC-41, KWM-2A, 516F-2, PM-2, 312B-5, 30L-1 antenna couplers, 490T-1, 490T-2, 490T-9, 490S-1, CU-1658A/ARC, CU-1669/GRC. Top dollar paid or trade for new amateur gear. Write or phone Bill Slep, Slep Electronics Company, Highway 441, Otto NC 28763; (704)-524-7519. BNB452

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

THE SIXTH TIME AROUND

Is the Fun! Poll an institution or does its supervisor just belong in one?

Let's see—in ham radio three qualifications are required before something can be considered an institution. Most important, you have to be old. Well, I'm 31 and the poll is six. That's not old, it's just "getting there."

Next, ham institutions have to be serious. I guess we flunk there, too. After all, how can you take anything called a Fun! Poll seriously?

Finally, to be an amateur radio institution you have to be outdated. We can't qualify under that category either, since more people notice the poll and respond to it every year.

So there you have it: The Fun! Poll is definitely not an institution. That's this year's first conclusion.

As usual, we had a lot of fun tabulating the results. This year, computers helped us in a big way: two Apple IIe's and an Apple IIc, plus a 20-megabyte hard-disk drive enabled us to handle the calculations. That's a lot of computing power for a non-institution.

I'd also like to thank WB2LWJ for entering all of that data and downloading the responses from CompuServe, The Source, and MCI Mail.

The envelopes, please...

ELEMENT 1
BACKGROUND

1) Sex:
A) Male—98%
B) Female—2%
Ham radio, like Mars in that old B-movie, needs women.

2) Age:
A) 15 or below—2%
B) 16–21—0%
C) 22–39—42%
D) 40–59—40%
E) 60 or above—16%
The graying of amateur radio. The kids are gone!

3) License class:
A) Novice—4%
B) Technician—10%
C) General—8%
D) Advanced—46%
E) Extra—32%
Fun! obviously attracts a very educated audience.

4) Number of years licensed:
A) 1 year or less—8%
B) 1–5 years—16%
C) 6–10 years—28%
D) 11–20 years—8%
E) 21 years and up—40%
A veteran crowd, indeed.

5) Do you have a new (post-March '78) call?
A) Yes—56%
B) No—44%
Next year, we'll have to ask, "Do you have an old (pre-March '78) call?"

6) How many hours a week do you devote to amateur radio?
A) 0–1 hour—20%
B) 2–5 hours—36%
C) 6–10 hours—22%
D) 11–20 hours—16%
E) 21 hours or more—6%
That's a fair amount of activity.

7) Which HF band do you use most?
A) 80–75 meters—30%
B) 40 meters—18%
C) 20 meters—26%
D) 15 and/or 10 meters—12%
E) Don't operate HF—14%
Who says the low bands are obsolete?

8) Which VHF/UHF band do you use most?
A) 6 meters—2%
B) 2 meters—64%
C) 220 MHz—8%
D) 420 MHz and/or up—6%
E) Don't operate VHF/UHF—20%
Hey, guys! Spread out!

9) Which mode do you use most?
A) SSB—44%
B) CW—26%
C) FM—24%
D) RTTY—2%
E) Other—4%
CW holds its own.

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenses.)
A) 0–$250—42%
B) $251–$500—20%
C) $501–$1,000—18%
D) $1,001–$2,500—12%
E) $2,501 and up—8%
Compared to many other hobbies, that's not a heck of a lot of money spent.

ELEMENT 2
SOCIAL CHARACTERISTICS

11) On the whole, hams are:
A) too young—0%
B) too old—58%
C) just the right age—42%
At least the age problem is getting some recognition.

12) Do you like rock music?
A) Yes—54%
B) No—46%
Not Lawrence Welk? Not on 2 meters?

13) Politically, how would you define yourself?
A) Conservative—52%
B) Middle-of-the-road—30%
C) Liberal—18%
K7UGA must be happy.

14) Should we get rid of the ARRL?
A) Yes—10%
B) No—90%
I guess that puts me in the minority. I'm for attacking Newington with a rettysnitch.

15) How old were you when you first became a ham?
A) 15 or below—26%
B) 16–21—28%
C) 22–39—32%
D) 40–59—12%
E) 60 or above—2%
See Question 2 and groan.

16) Should the FCC increase the speeds on amateur CW examinations?
A) Yes—6%
B) No—94%
How about increasing the speed on the written exam? Give those VEs a break.

17) Do you own a home computer?
A) Yes—74%
B) No—26%
I'd like to meet the hams who don't own one. Probably don't even use a digital display, heaven forbid.

18) If you answered "yes" to question 17, which brand?
A) Apple—20%
B) IBM—14%
C) Radio Shack—12%
D) Commodore—34%
E) Other—20%
Imagine if these figures reflected the computer market as a whole. Golly.

19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes—62%
B) No—38%
Those kids have to be doing something.

20) Are hams getting dumber?
A) Yes—42%
B) No—58%
Could have fooled us.

21) Do business interests deserve some of our virtually abandoned bands?
A) Yes—10%
B) No—90%
Use it or lose it, I say.

22) Should ham licenses have a minimum age requirement?
A) Yes—12%
B) No—88%
We have a de facto one anyway, right?

23) Should ham licenses have a maximum age requirement?

A) Yes—4%
B) No—96%
How about 100 years old as a limit, or would that eliminate too many hams? Only kidding, guys.

24) Should hams be subject to periodic retesting?
A) Yes—30%
B) No—70%
Why not? Could be fun. Imagine the ARRL board of directors flunking.

ELEMENT 3
OPERATING HABITS

25) If the users were restricted to data communication only (no phone or CW operation), would you be in favor of a no-code 220-MHz digital-class license?
A) Yes—74%
B) No—26%
What happened? A few years ago we would have been clobbered for even asking this question.

26) Would you be in favor of a no-code 220-MHz digital-class ticket if it permitted phone operation in addition to data transmission?
A) Yes—52%
B) No—48%
Ditto.

27) Have you ever used a personal computer in connection with your amateur radio activities?
A) Yes—66%
B) No—34%
Down 6 percent from last year.

28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes—16%
B) No—84%
Moderation, moderation!

29) What do you think of people who view pay television services with MDS converters and satellite dishes that are not approved by broadcasters?
A) They're skunks—2%
B) They're within their rights—98%
As a dish owner, I agree.

30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes—28%
B) No—72%
Let's rename them as "data bands."

31) Do you think DX nets have a place in ham radio?
A) Yes—76%
B) No—24%
A small place, I think.

32) Do you think nets in general have a place in ham radio?
A) Yes—88%
B) No—12%
As long as they're not DX nets.

33) The next time a ham operates from space, which band should he/she use?
A) 2 meters—52%
B) 220 MHz—14%
C) 450 MHz—14%
D) An even higher band—6%
E) Shouldn't bother to operate—14%
How about 160 meters? They'd have to carry the antenna on another orbiter.

34) If, while tuning across a band, you heard a net called "Jammers International" in progress, would you:
A) Jam it—2%
B) Ignore it—48%
C) Complain to the FCC or some other organization—18%
D) Listen—26%
E) Join it—6%
Hams are getting mellower in their old age.

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes—62%
B) No—38%
Sure, and all aspirins are alike.

36) If required, could you pass the FCC theory test for your license class?
A) Yes—88%
B) No—12%
But didn't Dick Bash go out of business?

37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes—4%
B) No—96%
Oops, the dial slipped.

38) Are you fluent in any computer language?
A) Yes—66%
B) No—34%
Of course everyone probably has his own definition of "fluent."

39) If you answered "yes" to Question 38, which language?
A) Basic—50%
B) Pascal—8%
C) Assembler—10%
D) Machine—10%
E) Other—22%
Basic wins again, but the other languages are gaining strength.

40) Do you feel competent to write a short Basic program?
A) Yes—72%
B) No—28%
10 PRINT "Hello"

41) Do you feel competent to replace the finals in a transistor-type rig?
A) Yes—92%
B) No—8%
Without killing yourself? Gee.

42) Do you solder together your own coax connectors?
A) Yes—100%
B) No—0%
What? Nobody uses solderless connectors?

43) Do you own a TVRO (home Earth satellite) system?
A) Yes—10%
B) No—90%
And HBO sees a market here?

44) Do you operate a packet-radio system?
A) Yes—12%
B) No—88%
This will be a question to watch in the future.

45) What do you think of contesting?
A) Great—10%
B) Good—18%
C) Okay—46%
D) Don't like it—14%
E) Despise it—12%
Sorry, WB2GFE.

46) What do you think of DXing?
A) Great—26%
B) Good—44%
C) Okay—26%
D) Don't like it—2%
E) Despise it—2%
A general vote of approval.

47) What do you think of repeaters?
A) Great—32%
B) Good—44%
C) Okay—18%
D) Don't like them—2%
E) Despise them—4%
But what do you think of the people on repeaters?

48) What do you think of traffic handling?
A) Great—10%
B) Good—48%
C) Okay—26%
D) Don't like it—10%
E) Despise it—6%
What's not to like? I mean, some people think exercise is fun.

49) If you heard an emergency net in progress, would you immediately join in and offer your services?
A) Yes—54%
B) No—46%
Little gold stars to the respondents who said they would join in only if they had traffic to pass.

50) Have you ever secretly hoped for a minor disaster to strike your community just so you could demonstrate your radio skills?
A) Yes—14%
B) No—86%
Regardless of the numbers, I still think most hams really do hope for trouble.

LOOKING WEST

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WA6ITF RETURNS

This column was originally written for publication in the January, 1982, issue of this magazine. The column was canceled by the decision to reformat 73, but I felt that I had an obligation to "...finish what I had started before going on." Next month, a look at what's happening today, with an emphasis on the emergence of regional band-planning super-councils.—WA6ITF.

I've often addressed the question of band-plan standardization in this column, not just with regard to the FM relay mode, but for all types of operation. This is because it is my strong belief that only through such standardization can every mode, special interest, and amateur be assured of spectrum to "do his own thing" on our crowded VHF (and now UHF) bands.

Over the years, I have put forth ideas on how such standardization could be accomplished, presented complete conceptual band plans, and what have you. It's interesting to note that some 15 years after the start of the VHF FM explosion only one of our amateur bands—220 to 225 MHz—has a band plan accepted on a national scale, including Southern California. As you are aware, the latter has been known to go its own way in most cases, caring little what the rest of the country is up to. Witness the decision back in '77 to use the "even-numbered" channel pairs in the 144.5–145.5-MHz repeater subband—every-

where else it's the "odd numbers" that are used. Some say that Southern California can't do anything right, but the hams of this area tend to consider themselves the true trend-setters; eventually "everyone else" will notice the error of his ways and come to this geographic locality's way of thinking.

In some cases it has happened. Inverted split-splits on 2 meters from 146 to 148 MHz were commonplace throughout half the nation until 20 kHz came along; the concept of inverting the tertiary channels was spawned by two well known Southern California hams, Burt Weiner K60QK and Bob Thornburg WB6JPI. This is common knowledge. At the time it also seemed to be a rather good alternative to the problems inherent with non-inverted 15-kHz tertiary channels. Like everything else in life, there was a trade-off involved. With non-inverted 15-kHz tertiaries, adjacent-channel repeaters can interfere with users. When you invert the 15-kHz channels, the user's radio sees a "30-kHz clear slot" for the most part, but now repeaters can interfere with other repeaters. This is because the output of Repeater A is only 15 kHz from the input to Repeater B. Obviously, where the terrain provides for geographic shielding and/or system separation, this is no problem. In cases where it doesn't, then some elaborate equipment is necessary to make the concept play. This may include such items as specially designed receivers with high dynamic range figures, suck-out traps and cavities, circulators, and the like. The system does work, as has been proven here and elsewhere for the better part of 12-1/2 years now, but at best, it's still a trade-off—in this case protecting the "user's radio" at the expense of overall repeater system performance.

Many years ago, an amateur in the Northeast named George Le Dioux K1TKJ came up with an even better solution. This was back in the late 1960s, FM's formative era. George suggested two changes that would have avoided the many pitfalls we've faced and had to find ways around. K1TKJ's idea was to put all two-meter repeaters on 20-kHz inter-system spacing, and utilize an input-to-output spacing of 1 MHz. Had this been done back in 1969, we would never have faced the concept of 15-kHz tertiary splits. True, there wouldn't have been as many repeater pairs available, but overall technological system operation would have been vastly improved. But this was not to be the case. Le Dioux's ideas were ignored and the nation stayed with 30-kHz inter-system spacing and 600-kHz input-to-output separation. There were a number of reasons for this, the primary one being that at the time of the K1TKJ proposal, Technician-class operators were not permitted operation in the 147–148-MHz spectrum. With most radios being crystal-controlled in that era, 147.97 was considered the ex-officio top end of the "open repeater band."

Then came repeater deregulation. Technicians were granted operating privileges in the 147-MHz region. The doctrines of "Semi-Automatic" and "Fully Automatic" remote controls were established in D.C. and the big repeater rush was on. (It should be said that two Southern California amateurs were directly responsible for this first of many deregulatory moves with regard to repeater operation. They are Capt. Dick McKay K6VGP and Fred Deeg N6FD. Without their unceasing efforts on our behalf, the deregulatory process might never have come about.) Soon we were out of 30-kHz channels. The Northeast and then the entire eastern seaboard opted, ever reluctantly, to initiate the use of 15-kHz inter-system spacing. At that time little was known with regard to 15-kHz system spacing, so the decision was made to go "standard" right-side-up configuration.

The early days were hectic. The average ham transceiver of the day had been developed in the era of 60-kHz spacing; most could hack 30 kHz with little degradation in performance, but 15 kHz was another story. The same held true for a number of years through the mid 1970s. To this day I and a bunch of friends hold the somewhat dubious honor of having placed the first non-inverted 15-kHz tertiary machine in the nation into operation. Its callsign was WA2ZWP; it was located atop the Williamsburg Bank Building in Brooklyn, New York, on a frequency pair of 146.205 in, 146.805 out. No matter what we tried, it still wreaked havoc on our two neighboring systems (.19/.79 and .25/.85). Not to the systems themselves, but to those using these two machines. Then again, they each only got it from "one side." Our users were caught smack dab between the other two systems, and it took a lot of research by our Technical Chairman, Dave Kuraner, into new filters to make most of our users' radios function on the system. In fact, Dave, Larry Levy, and I were the only three who could really make use of the system in the early days. We were the lucky ones. We were using converted Motorola and RCA landmobile radios which had the needed selectivity. Most of the others were not that fortunate. Somehow, the WA2ZWP repeater survived for a few years. It led the way for others who were intrepid enough to copy our foolishness. Soon a de facto 15-kHz standard existed in the Northeast and spread elsewhere as areas ran out of 30-kHz channel pairs. It should also be noted that in spearheading the use of 15-kHz channel pairs, the Northeast was ahead of everyone else. It would be several years before the next major FM-oriented area would make the move, and when it did it would be in a different vein. Southern California elected to invert its tertiary channels as already mentioned, and most of the country west of the Continental Divide eventually followed suit as the need arose to implement utilization of 15-kHz channel pairs.

The ARRL gave its *official* blessing to either 15-kHz plan, but most of those placing repeaters into operation in a given area have kept with the norms established for that geographic region. Oh. . .there have been a few renegades here and there, but few problems have arisen and the status quo has been maintained. But many wondered if there was a better way. Most radios sold these days do operate fairly well on even, right-side-up 15-kHz channels, though in a 30-kHz or even an inverted 15-kHz environment, their overall operation seems greatly improved. I suspect that many of you reading this were not even around in the 30-kHz days. Very few, if any, are left from the 60-kHz era, so few are familiar with the way two meters sounded back then. I won't try to reconstruct the past other than to say that in the old days repeaters were fairly silent, with most FM being simplex in nature. How things have changed.

Is there an alternative to implementing 15-kHz tertiaries when you run out of the 30-kHz-split channel pairs? What about K1TKJ's old "Let's revamp to 20-kHz and 1-MHz input-to-output spacing"? Most amateurs felt that it was too late to go this route because of the investment in established hardware—both "system" and "user" hardware. At least one geographic locality seems to have decided to buck today's trend and has opted for something akin to the old K1TKJ concept. They have instituted the use of 20-kHz inter-system spacing, but have retained the standard 600-kHz input-to-output spacing. Actually, this is not so much an adaptation of K1TKJ's ideas as it is the adoption of the NARC 144.5–145.5-MHz band plan for the upper two MHz of the band. The area in question is the Pacific Northwest, and results are reported as being very positive. So much, in fact, that now the Canadian province of British Columbia has joined with Washington, Oregon, Utah, Montana, Texas, Arizona, New Mexico, Idaho, and eastern states like Alabama and Michigan to make this more than an experiment. Rather, things have reached the point where 20-kHz inter-system spacing on both the upper and lower repeater subbands on two meters must be considered a true regional band plan.

I am not saying that we should scrap years of commitment to 30-kHz and 15-kHz operation, but what has been accomplished in the Pacific Northwest is of definite note. They did not double the number of available channel pairs, as would have been the case had they opted for one of the 15-kHz plans, and they didn't have to fight any of the 15-kHz problems. Nor did anyone have to run out and buy a new radio, either. As pointed out in the British Columbia FM Communication Association newsletter, most amateurs with crystal-controlled radios had no problem swinging their crystals to the closest of the new 20-kHz pairs. As for the older 15-kHz-based synthesized sets, the BCFMA newsletter went on to explain that these radios could either be converted back to their original 20-kHz centers, since that was the original Japanese design concept to start with, or another "mix-down" to permit 5-kHz or 10-kHz incrementation could be added. Newer synthesized radios,

the article added, were already equipped for either 10-kHz incrementation with 5-kHz offset, or were incremented in 5-kHz steps. For those units, no mods were needed at all.

A few years ago there was but one band plan for two meters. It was known as the Modified Texas Plan and it sufficed for its day. It was based upon 30-kHz intersystem spacing and was the plan first modified in the Northeast to accept upright 15-kHz tertiaries, and then in the Southwest to accept inverted tertiaries. Because of politics, all of these plans have won the "Official Approval" of the League's Board of Directors. Had the ARRL approved only one, we would not be facing a new political dilemma, that of having to choose from three band plans. There is mounting political pressure for the national implementation of the Pacific Northwest band plan. And it's not all coming from the Pacific Northwest, either. This reporter feels that it may be a bit too late to find a "true national standard," much less get everyone to agree on its implementation and use. It could happen, but I, for one, have stopped holding my breath.

The SCRRBA Report: Part III

We now begin the third and final installment of the SCRRBA report on the future of voluntary UHF coordination. While this report was primarily prepared for consumption in the Southern California area, it holds importance for all areas and all spectra where coordination is scarce. How to solve things? Here's one group's opinion:

Keeping Current

One of the easiest ways in which the owner of a coordinated system can aid the Technical Committee is by remaining in close contact with us. Many coordinations were performed over five years ago. Having experienced no difficulties in the operation of their machines on the coordinated channels, the owners of these machines have not kept current with our Technical Committee. Since we are constantly referring to the file cabinets which contain the collected coordination records (which contain all paperwork received by the committee regarding each system), it becomes readily apparent how old some of these files are.

In the United States the average household changes living quarters about once every five years; in Southern California it may be more frequent. Any coordination file which has not been updated in the last five years is probably useless to the committee as a source of address and telephone information. We have an independent way of verifying this statement: Each time we mail out newsletters, we have approximately 20% returned by the Post Office marked "Addressee Unknown."

It is the responsibility of the operator of a coordinated system both to recognize the value of a UHF frequency pair in Southern California and to "protect his investment" by remaining in permanent contact with the Technical Committee. It only takes a few minutes to complete and mail a coordination update and it's an excellent "insurance policy." If you're not sure when you last updated your coordination, do it now. We can never have too much data.

Avoid Wanderlust

Earlier we discussed the problems caused by "self-coordination" of new UHF systems within the array of existing repeaters and remote bases. The Technical Committee has also had problems, on a more or less continuing basis, with a different form of self-coordination performed by operators of presently functioning UHF systems: The movement of an existing system from one location where it was coordinated to a new location where it isn't coordinated.

The committee must emphasize that the coordination of a specific UHF pair for a particular individual or group is *only* for utilization at an exact land location for coverage of a specific geographic area. Coordination of a channel pair does not imply ownership with "rights" to transport the pair anywhere around Southern California. If it is necessary for the owner to move his system to a new land location, he must apply to the committee, in writing, in advance of the move, for recoordination of that system. The committee will determine whether the system can be operated at the new location without receiving interference from or creating interference with other co-channel and/or co-site systems. Please recall that the 70-cm band is not so heavily coordinated that a small change in the operation of a single system has the potential for causing a major impact on the entire regional coordination array. It is not the intention of the committee to attempt to prevent coordinated systems from moving. If it is at all feasible for the system to operate from the proposed new location, an OK will be given quickly. Rather, it is the committee's desire to prevent unnecessary work and expense, both for itself and for the owners of the affected systems.

Expect Company

Most Southern California UHF channel pairs between 440 and 450 MHz now support more than one system, and co-sharing of pairs will have to increase in the future. Long ago the committee learned an important lesson with regard to co-sharing of channel pairs: Everyone favors the practice. . .but only in principle. In its early days, the committee would contact the holder of a coordinated channel pair and request his approval for the co-sharing of his pair with another system, located far enough away geographically that mutual system interaction would be minimal. The initial response was almost always affirmative; later the complaints would start.

The committee learned that an approval for co-sharing should be interpreted as follows: "I am certainly agreeable to sharing the channel pair, as long as I can climb into my automobile and drive a minimum of 5 hours in any direction and still not hear the other system!" Therefore, we long ago stopped asking for advance approval.

SCRRBA will continue to coordinate co-channel systems using the best fit, on a geographical co-sharing basis, between a previously coordinated system and one of several completed applications for frequency coordination. A new system will be coordinated to co-share a pair with an existing system so that minimum practical overlap occurs between the users of each system. The Technical Committee will notify owners of existing systems that a specific new co-channel system has been coordinated.

In some instances there may be an occasional overlap in coverage, as mobiles from one group find themselves in specific locations which also put them within range of the other machine. This is to be expected. To prevent unnecessary access, the committee recommends CTCSS protection for mountaintop repeaters. If necessary, full CTCSS systems can be used to protect against occasional reception of the other system's talkback.

Toward The Future

The Technical Committee should make a full and complete report to the Southern California UHF community about the current state of the coordination process and explain how little flexibility the committee has in the performance of UHF frequency coordination (and why seemingly reasonable requests cannot be fulfilled). Moreover, it is the committee's hope that the community, after gaining this information, will act with the cohesiveness necessary to protect its considerable investment of time, money, and talent.

Southern California is recognized as the national leader in amateur UHF relay-system operation. Nowhere else in the country do systems exist which rival ours in complexity, sophistication, and length of service. Whether or not we can continue to operate our systems successfully in the future depends directly upon how we, individually and collectively, value and support the community's frequency-coordination program.

Summation

What you have just read is the third part of a three-installment series on the future of voluntary relay-system coordination. It was gleaned from the June, 1981, issue of the SCRRBA newsletter. Parts 1 and 2 of this series appeared in the October and November, 1981, Looking West columns.

The entire series was condensed from a report to all Southern California UHF users from the Southern California Repeater Remote Base Association and was prepared by Gordon Schlessinger WA6LBV of the SCRRBA Technical Committee. While its initial audience was obvious, in retrospect I felt that anyone involved in putting up a repeater or helping get it coordinated could learn from what this particular group is accomplishing. Yes, it was written about the Southern California UHF repeater/remote, but there is something in it for all involved in repeaters or remotes, regardless of the band they operate on.■

QRP

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PLANNING FOR GOOD FIELD DAYS TO REMEMBER

"Fascinating, frustrating, or fun, Field Days are good tests of amateurs' engineering and operating ability." This was the opening sentence in an article in the June, 1969, issue of *73* Magazine entitled "A Field Day to Remember." That article told how a group of inexperienced operators quickly planned, set up, and operated a makeshift Field Day station in the 1968 Field Day contest. It was fun and a good learning experience for those involved.

In the 17 years since then, the author of that article has participated in more than a dozen Field Day contests. In the last 10 years, he has functioned as the Field Day Coodinator for the Principia College Amateur Radio Club.

The purpose of this article is to present ideas and information gained from these experiences that could help other clubs have successful Field Day stations.

Many amateur operators consider the annual Field Day the most important amateur radio contest of the year. These operators might be called the "serious contesters." They want to work hard to make the best score possible. Each year they aim to make a better score than they did the previous year. Serious contesters are sometimes young high-speed ("hot shot") operators who can go 24 hours without sleep. Other serious contesters are older men (and sometimes women) who like to compete and can compete well in Field Day contests long after they are too old to compete in athletic sports such as football, basketball, or baseball.

Other operators are less competitive and think of Field Day as a weekend social event in which they can relax after a hard week's work and have fun with other hams. These operators could be called the "socializers." Many clubs have both serious contesters and socializers who come to Field Days. Too often, the socializers do not want to do much of the work of setting up and running a Field Day station. The serious contesters resent having to do nearly all the hard work, with little or no help from the socializers.

This article will present ideas which (hopefully) will satisfy the needs of both the serious contesters and the socializers.

If a Field Day station is powered by a gasoline engine driven ac generator, keeping the generator running for 24 hours is unpleasant work. The noise of the generator creates mental fatigue, which is not helpful to the operators.

Running a Class 1A battery-powered QRP Field Day station eliminates both the noise of the generator and the work of keeping it running. Furthermore, because of the QRP multiplier, it's easier to make a good score with a QRP Class 1A battery-powered station than with a higher powered generator-powered station. For the serious contesters, a QRP Class 1A battery-powered station will provide a better score—with less work and without the tiresome noise of a generator.

Here's Why

The Field Day rules give a multiplier of five for each contact made if the transmitter's rf output is 5 Watts or less and the station is powered by batteries. This makes it possible for QRP Class 1A battery-powered stations to make higher scores than more powerful stations using gasoline engine driven ac generators (see Table 1). A QRP Class 1A battery-powered station is ideal for a club (or other group of operators) that is relatively small (three to ten serious, competitive operators). A club may have only a small group of serious contesters, and a Class 1A battery-powered QRP station would be ideal for this group (see Table 2).

How Our Group Got Started With QRP Field Days

Using power from a gasoline engine driven generator, the Principia College Amateur Radio Club did rather poorly in the 1980 Field Day contest. During the contest, a ham drove up the road from the station and tossed an antenna up into a tree. He put his little Heathkit HW-8 on a card table and connected it to the antenna, a telegraph key, and his car battery. Then he proceeded to make contacts. Many in the club were very impressed.

In discussing the club's lack of success in the 1980 contest, one member of the group made a "radical suggestion": The club should use an HW-8 transceiver in the 1981 contest to do away with the noise and work of using a generator. The others in the club agreed. In 1981, the HW-8 station made 235 contacts and 2,650 points, the highest score the club had ever made. During the contest, WØVM and his logger started operating at 11 p.m. Saturday. Others were supposed to take over at 2 a.m. Sunday. However, because there was no generator noise, these "others" fell asleep and did not go to the station until 6 a.m. WØVM and his logger were having fun making 10 contacts per hour and so didn't mind the extra operating time.

Planning a QRP Field Day

Soon after the end of a Field Day contest, members of the group can share ideas for making the next year's Field Day better. This planning can start as early as April—or even earlier, if experimenting with antennas is a part of this work. As soon as they are available, the Field Day paper forms (summary sheet, dupe sheets, etc.) should be obtained from the American Radio Relay League, 225 Main Street, Newington CT 06111. You can study the Field Day rules that appear in the May issue of *OST*. (It might be a good idea to have a few copies of the rules handy on Field Day.)

The Field Day Site

It's important to obtain a good site for your Field Day station. The site should be on high ground and



Photo A. 1982's FD station in action.

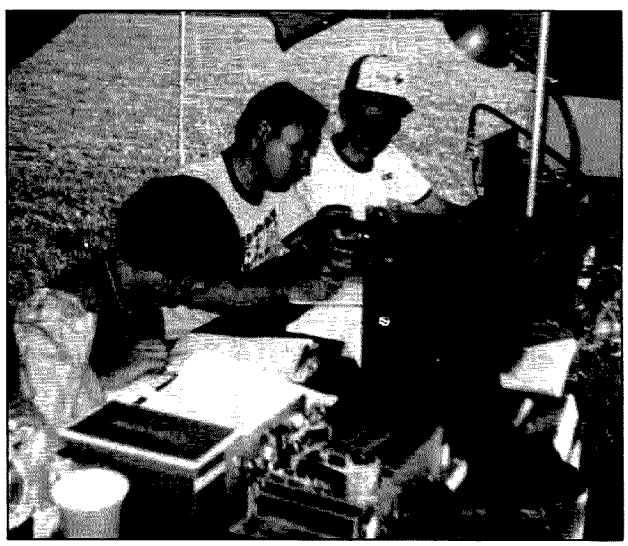


Photo B. The Principia College ARC operating 1A Battery: (l–r) KAØSAC, WBØVOE, K9BO.

Year	Battery-powered Station Scores	Ordinary Station Scores
1980	7015	4400
1981	7220	4828
1982	9585	5852
1983	7330	6152
1984	7900	5698
1985	9270	6544

Table 1. The scores of the top Class 1A QRP battery-powered stations compared with the top scores of the ordinary Class 1A stations for the years 1980–1985.

1980	W5VBO	3
1981	W1MJ	11
1982	N4BP	3
1983	N4BP	3
1984	K9RS	7
1985	KP4FI	6

Table 2. The number of operators of the top Class 1A QRP battery-operated stations for 1980–1985.

in the clear. Our group prefers a site with no trees or only a few trees around the edges. We have good temporary antenna supports and run the antennas north and south for good east and west coverage. Field Day stations can be located in public parks, on the grounds of schools, on farms, or on other private property. It's important to make arrangements early with the people who control the site. The site should have toilet and washroom facilities nearby. Picnic tables are also useful.

Shelter

The shelter for the station should be strong so that a storm cannot blow it down, as happened to our group in 1984. If you use an open canopy, set up a strong tent beside it into which you can move the station if a storm comes up. Trailers, campers, cottages, barns, and trucks can also house Field Day stations. For ease in operating, logging, and duping, the shelter should be big enough to include a large table with a shelf on it, which can hold antenna tuners, an swr meter, and keyers.

Having a place nearby where Field Day contestants who are not operating can rest and sleep is most helpful. This place could be an extra tent or camper, or a nearby building. People can bring their own cots, sleeping bags, and blankets.

Bonus Points

The Field Day rules provide 100 bonus points for publicity: You must submit an article to a local newspaper for publication. (Radio or television publicity for the Field Day can sometimes be obtained.) A Field Day article should tell about the purposes of Field Day and about the setting up of emergency type stations all over the United States and southern Canada. Also include in the article the name of the club (or nonclub group), the location of the Field Day station, and the dates and hours of the Field Day contest. Other information appropriate for the article is the type of station (Class 1A battery-operated in the case of a QRP station), names of the group's operators, and the fact that visitors are welcome.

Submit the Field Day article to the paper in late May or very early June so it will be printed in June before the Field Day weekend. It helps if you deliver the article in person to the editor of the paper, so you can emphasize the importance of the Field Day contest and explain that it's *the big amateur radio contest of the year*! Keep a copy of the article to send to the ARRL along with the summary sheet and other papers, in case the newspaper doesn't print the article. Proof that the article has been submitted will provide the 100 bonus points for publicity. If the article is printed, send a copy of it along with the other documents to the ARRL after the contest.

If you plan to make five contacts with "natural power" for an additional 100 bonus points, obtain a 12-volt motorcycle battery and a solar charger. (Perhaps you could borrow a solar charger from a college physics department.) Use the battery until it is fairly well discharged, then connect it to the solar charger and charge it on sunny days. At the slow charging rate of the solar charger (120 milliamps in full sun for the one our group used), it will take many hours to charge up the motorcycle battery. This charging might well start in the middle of May.

Power Supply

Two fully charged automobile batteries will run a transceiver with 5-Watt rf output for the full Field Day period. This includes running a 12-volt lamp during the night. (If the weather is cool, you can use a gasoline lamp, such as a Coleman lamp, for lighting, and its heat will be appreciated.)

Transceivers

The transceiver for the station should be one which has a single signal superheterodyne receiver. For best results, the receiver should have an i-f filter of 500 or fewer Hertz, plus an audio filter. A Ten-Tec Argosy transceiver used in its low power mode is an excellent Field Day transceiver. Although you can make contacts with transceivers with direct-conversion receivers, the fact that this type of receiver brings in each station at two places on the dial makes undesirable QRM. There's more than enough QRM during Field Day without adding to it by using a direct-conversion type of receiver! It should go without saying that it's desirable, if not necessary, to have a backup transceiver available.

Antennas

Having excellent antennas is of greatest importance for QRP Field Day stations. It's helpful for a station to have two antennas and the ability to instantly switch between them. If possible, the antennas should have gain as compared to a conventional half-wave dipole.

An allband tuned doublet or "center fed zepp" with 66 feet each side of the center is a good antenna for Field Day use. In 1983, using only this antenna, the Principia College Amateur Radio Club made 394 contacts in 24 hours with the 5-Watt rf output of a Ten-Tec Argosy transceiver. With its wires running north and south, the antenna was an unusually good half-wave dipole on 80 meters. On 40 meters, the antenna was "two half waves in phase" for a gain of 1.8 dB in the east and west directions (as compared to a dipole). On the 20- and 15-meter bands, the gain in the major lobes of the four-leafed-clover pattern was probably more than 2 dB. Because the antenna was in the form of an inverted vee with its center up 40 feet and the ends up 15–20 feet, the antenna sent well in all directions, on all bands.

If your station has two antennas, the second antenna should have much gain on the 20- and 15-meter bands. If the station is on the East Coast, a beam antenna aimed west would be the logical kind of antenna to use. For a West Coast station, a beam antenna aimed east would be appropriate. In the middle of the United States, you need a bi-directional beam. It isn't practical to rotate a beam on Field Day. This takes too much time, even if you could devise a 12-volt rotor or "armstrong" rotating system. Bi-directional beams are not hard to build and do work well. Vertically polarized bi-directional beams send out a wider beam than do horizontal beams, and this makes them good for Field Day use. An end fed, 20-meter, vertical W8JK, "end fire," bi-directional beam fed with tuned feeders works well on both 20 and 15 meters and has a gain of 4 dB as compared to a dipole (for both bands).

Each Field Day antenna system should have its own antenna tuner, and there must be a coax switch with which the operator can instantly switch the output of the transceiver from one antenna tuner to the other. All Field Day antennas should be fed with balanced tuned feeders so that the 5-Watt rf output of the transceiver will get into the antenna as effectively as possible. Ordinary vertical antennas (not vertically polarized beams) are not usually effective for use with the QRP Field Day station.

Field Day Operating QRP

Having a meeting of the operators, loggers, and dupers to discuss the rules, operating, logging, and duping procedures is helpful. To make the best score, it's a good idea to have the best operators do most of the operating. Other operators are usually glad to contribute by doing the logging and duping. It's also good to use call letters that are short, easy to send, and easy to read, preferably ending in a dah.

The following ideas will help a QRP station make contacts:

1. *Answer* CQs rather than call CQ.

2. Use a code speed that isn't too fast. The sending should be clear and accurate.

3. Conserve time by making the exchanges as brief as possible. Use a minimum of words. Sending de (your station's call) without sending the other station's call saves time.

4. Quick "tailgating" after a station has completed its exchange often results in a quickly made contact.

5. A computerized keyer programmed to send the exchange when a button is pushed is helpful.

6. Do not spend too much time trying to make a contact with a given station. If a contact is not made after three calls, move on and call another station.

7. Go to a less crowded part of a band if you cannot make contacts in a crowded part of the band.

Band Selection and Band Changing

Listening to the bands immediately before the contest starts will give an indication of which bands are open and active. (There will be many Field Day stations testing.) If the 15-meter band is open, you can make contacts there until the band dies or is "fished out." Twenty meters is also a good daytime band on which to start and is usually good well into the night. It's a good idea to spend most of the time on bands for which the antennas have the most gain. Forty meters is usually good both day and night. Eighty meters is strictly a nighttime band and, with a good antenna, will provide many contacts.

The station should stay on a band as long as it is making frequent contacts. When the number of contacts per hour starts to decline, it's time to change to another band. Later in the contest, the station can go back to bands that were fished out earlier and may find many "new" stations to work. Using separate log sheets for each band helps in making out the summary sheet after the contest is over.

Having a good support group of people who are not operators is helpful. Wives and other family members of the operators can supply food and soft drinks. A Saturday evening pot luck supper in which the operators can take turns eating and operating adds to the enjoyment of Field Day. Operators can bring their own Saturday noon lunch, Sunday morning breakfast, and Sunday noon lunch.

Setting Up the Station

Some clubs like to set up their antennas on Friday evening. The rest of the station is set up on Saturday morning. This often takes more time than one would think. If the group starts at 9 a.m. Saturday, everything can be ready and tested by the starting time. You can use a good alarm clock (hand wound or battery operated) for logging. It's easier and less confusing to keep the log in local time, rather than to try to keep it in UTC.

A check list of everything needed will help to keep the group from forgetting anything. The Boy Scout motto "Be prepared" is a good one for Field Day. Being extra well prepared helps prevent Murphy's Law from shutting down the station.

Keeping the Socializers Happy

The socializers in a club are likely to be "phone hams" ("phoney hams" in the eyes of the serious contesters), who have little interest in helping to run a QRP battery-operated CW station. To meet their needs, they can set up and operate another station with call letters different from those the station of the serious contesters uses. This station could be called the "fun station," and the station of the serious contesters the "contest station." The fun station should be located quite far, but not too far, from the contest station and powered by commercial power mains. Using commercial power eliminates the obnoxious noise of a generator and the unpleasant work of keeping the generator running.

In most cases, the QRP contest station would operate on CW and the fun station on the phone bands. The contest station would have the best possible antennas, while the fun station would use a coax-fed antenna with parallel elements or other devices that would make the antenna work on several frequency bands. (A "trap vertical" with radials lying on the ground could be used; it would be easy to put up and would not take up much space.)

The fun station should be managed in ways that would encourage visitors to become interested in amateur radio. The fun station operators should explain amateur radio to visitors and give them materials designed to get people interested in the amateur radio hobby. (Nearly all hams like to talk about their hobby to any people who will listen to them. Hi!)

Another good fun station activity would be to let visitors get behind the microphone and make contacts. The licensed operator in charge of the station should carefully supervise these contacts and be responsible for them. Visitors could also share in the logging of contacts and marking of the dupe sheets. These activities, shared with visitors, would provide training in contest operating techniques.

The fun station should operate only on frequencies that will not interfere with the QRP contest station. Given a reasonable distance between the two stations and the fact that one station is on CW and the other station is on phone, interference between stations should not be a problem.

To arouse interest and stimulate activity, the operators of the fun station might be encouraged to be competitive enough to try to make as many contacts as the QRP station makes on CW. (It is assumed that the fun station will be a medium powered station.) If the fun station operators do not want to stay around all night, they could try to make as many contacts per hour as the contest station during the times when the fun station is on the air.

If possible, the fun station should use call letters that will naturally promote fun. One year the use of the call letters K9BO brought many humorous remarks from operators of stations worked. One of these was "Canine B.O., you must be a dirty dog." That year, it was singularly appropriate that K9BO made its last contact with station WØPU, operated by a female operator who gave the call letters as "Whiskey Zero Pink Underwear."

On the next Field Day, make both your serious contesters and your socializers happy by running two stations, each with its own call letters. May your fun station provide lots of fun and may your QRP Class 1A battery-operated contest station make the best score that your club ever had!■



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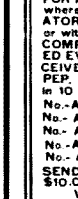
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NEVER SAY DIE

from page 12

the air, you'll always be making a first impression on someone.

I have a fairly good vocabulary—the result of living with an upper middle class family which made a point of "looking it up" when anyone misused a word. Just as I dress to convey to others the real Wayne Green—I also am careful in my speech when meeting someone new. As I know them better I am more flexible in my dressing and my speech. I use dirty words sparingly, using them to communicate where needed for shock value—extreme emphasis.

The language used between a group on a 75m net who have been talking with each other nightly for months is going to be different from that used in first contacts. We should allow more latitude.

What Can We Do?

Okay, let's address the situation head on. Let's say you hear some jerk going way beyond the bounds of decency in language. What should you do? Should you break in and arrogantly tell the sonofabitch off? Should you merely tune off the channel and sigh over what ham radio has come to? Should you try to jam the bastard? Note my use of emotion-stirring words as I talk about the people who are making you mad—mad when you just think about it! I suspect you agreed with my expressing my obvious distaste for these filthy, disgusting people with appropriate words.

My recommendation is to break in when you hear the bounds of propriety being overstepped—and I mean way overstepped, not just stretched a bit. Break in and tell the chap you find his language inappropriate for amateur radio. Be polite but firm. I guarantee he'll try to get you so mad you'll be inclined to sink to his level—so my suggestion is to make your statement and then tune the hell off the frequency before he can answer. Think about it. One thing your nervous system does not need is an attack on you—even over the air. It doesn't take very many such acrimonious events before you'll find yourself avoiding your ham rig. No, say your piece as unemotionally as you can and leave the channel so you won't get burned by the fireworks.

You may think that your efforts to clean up the bands will be wasted. But look at it this way—tens of thousands of hams are reading this editorial. Maybe only a few hundred will have the guts to actually do something about the language on our bands, but by the time a bad language user has been reprimanded—and been unable to pick a fight over it, thus getting his jollies, he'll either start to clean up his act or will find himself hesitating to turn on his rig. If hamming isn't fun, we don't do it—so the idea is to make it less fun for the people who are making it less fun for us.

No, it is not necessary for you to give your call letters when you are helping to clean up our bands. And none of that sanctimonious crap (heh!) about it being illegal to transmit without giving your call. I don't see the rules helping us with bad language or bad operating, so don't wave rules at me. I use my call letters when I think they are needed, not to satisfy the FCC. The FCC could care less. They're getting out of the monitoring business anyway, so if we want our ham bands to be fun we damned well have to accept the responsibility for keeping them fun.

The H&R Block

Non Illigitimi Carborundum—don't let the bastards wear you down. Wear them down instead. Wear them down by hit-and-run tactics—what I call the H&R Block.

This technique is effective on the low bands—and to some degree on VHF. But when you run into foul language on your repeater you may need a more effective approach. Here, where your miscreant is nearby, you have a whole array of possibilities.

Just as I recommend every radio club have an I-Team—a group of three or so experienced amateurs who can keep their cool who go out and investigate every interference complaint against a local amateur—I also recommend clubs appoint a UFO-Team to handle perverse operators. UFO—Unofficial Friendly Operators.

The first step for the UFO-Team is to pay a friendly visit to a perpetrator and explain the club's view of his operating. If this doesn't work, a second visit with some tapes of his activities, perhaps accompanied by a somewhat larger representation from the club, might get the message across. Hard-core nasties may call for creative measures. Would tapes of his operating and a note to neighbors, his family, his employer, and so forth help create a more relaxed atmosphere?

When the crazies group for support, your approach might best be to work on each one as a separate case and ignore the group. Each then can individually feel the weight of your group disapproval, but without the support of his crazy group to back him up.

Don't Be Officious

If you use your strength to swat a flea with a sledge, you'll lose your credibility. Hassling someone for minor indiscretions will waste your power. Save your muscle for the hard-core cases. You have to be careful in selecting a club UFO-Team. There is a tendency for the power-seekers to find these jobs. You'll soon find them with UFO-Team signs on their cars, flashing red lights, and a barrage of tape recorders in their shack as they tune the ham bands, eagerly seeking anything and everything to hassle.

Feedback

If your club has some success with an I-Team or a UFO-Team, make sure someone writes it up so I can publish it in *73*. We don't have to live with bad operators—we just have to retrain them. Let me hear your war stories—particularly those where you've won some battles.

ATLANTA IN JULY?

The biggest hamfest in the Southeast is the Atlanta HamFestival . . . this year July 19–20. There are only a few major hamfests where you'll see all of the major manufacturers showing off their newest gear—where you can corner them and get answers, where you can get your hands on just about every ham product made—and Atlanta is one.

Yep, I'm planning on being there and I'll be giving a performance—bring your seat belt and your tranquilizers.

Atlanta is always a joy to visit. It's really geared for visitors. They're working to rebuild Underground Atlanta, but in the meanwhile you don't want to miss the refurbished Cyclorama—their updated zoo—and Stone Mountain, a nearby amusement park.

For you fat people (like me) there are great wonders. I seldom miss a pass at Aunt Fanny's Cabin. When I'm able to get someone to invite me out, I enjoy The Abbey—one of Atlanta's best (and most expensive) restaurants. Fatties will also go bananas over the buffet in the Marriott. There aren't many dessert buffets, but they've got one. Ice cream sundaes and banana splits, ice cream on pies, ice cream and cake . . . mmmmmmm. I hope they haven't changed that.

Jazz fans will enjoy Walter Mitty's, where you'll probably see the Trio-Kenwood gang tripping.

It's time you got serious about packet radio anyway, so check 'em all out at Atlanta.

Y'all come, y'hear?

CAN WE REBUILD OUR LOST INFRASTRUCTURE

A brief industry meeting was held during Miami Hamboree last February. This was a follow-up on last year's meeting where it was decided to go ahead with a ham comic book project. The industry agreed to ante up $10,000 for the project, which would be matched by an equal amount from the ARRL. The industry ante on this is still light.

Not much has happened yet on the project. It was discussed and agreed that it should continue as a test to see if this approach will result in some growth. There was no disagreement that amateur radio is in desperate need of growth—that without *something* to make it grow, we're looking at a dying hobby.

There's a tendency to put todays kids down—to blame the kids because they're not getting excited about amateur radio. I hear lots of excuses—well, hell, the kids are playing with computers these days—they're watching television. Bull. When I was a kid there were plenty of other things for kids to be interested in—has everyone forgotten that kids have always had plenty of things to do?

No, blaming the kids is a copout. The problem isn't the kids at all, it's plain and simple our own fault. I got interested in amateur radio about the time I entered high school—lo and behold, there was a school ham club, W2ANU. We got together a couple afternoons a week and talked hamming. We put our club station on the air and made contacts. We pored over

QST and *Radio* together. We visited each others' ham shacks.

We hams sat around arguing with each other twenty years ago when this whole infrastructure was destroyed by the League's "incentive licensing" proposal. Thousands of school radio clubs folded, right along with 85% of the ham stores around the country and 95% of the American manufacturers. That was a catastrophe we're still paying for.

Without the thousands of high school ham clubs to fan the starting flames of ham interest, this whole source of newcomers has almost totally dried up.

We didn't help this situation with our regular community ham clubs. In almost every instance these clubs became controlled by old-timers—old-timers who wanted to talk with old-timers, not kids. Kids are noisy. Kids ask a lot of dumb questions. Kids mean the club has to have a damned code class. Kids mean someone has to try and teach theory. Kids are impatient with the usual endless club bickering. Kids are impatient with long boring business meetings. Kids get fed up with committee reports and interminable arguments over trivia. So old-timers have run the kids out of most clubs. So we don't have any kids these days—surprise, surprise.

I'm wondering—even if a ham comic book does arouse some interest—so what? Where have the kids to turn for reinforcement? If my high school hadn't had a ham club, would I have had my interest in hamming fanned enough to get a ticket? Maybe. Probably not. I could easily have gotten involved with audio and hi-fi and drifted away from amateur radio. I had many friends who did just that.

It wasn't hamming itself which attracted me as much as it was having fun with other kids. I first listened—SWLing. Then I started building electronic gadgets and radios. Then I was guided by the school radio club members toward getting my own license. This was reinforced by daily contact with other similarly interested kids. From there I got on my roller skates and started visiting the nearby hams I heard on the air. I think I visited every active ham in Brooklyn.

The code put me off for a long time. Some of my friends got W2Ms. I'm sure I would have been licensed at least two years earlier if I'd stayed in the high school with the radio club (Eramus HS), but I changed to a small private school with no ham club and lost the impetus. When I went off to college they had a ham club (W2SZ) and I almost immediately got licensed. This is what I see happening today—even when kids get excited about amateur radio, the excitement almost always blows over without the constant reinforcement of a school ham club.

So I'm not at all convinced that a ham comic book is going to do much for us in the long run. No, we not only need to make the fun of amateur radio known to kids, we have to rebuild the whole infrastructure which used to bring kids into the hobby. We need to get ham clubs back into the schools. We need to get every active community ham club dedicated to getting kids involved and seeing that their first tentative interest is fanned to a roaring flame—maybe even to a license. Avuncular old-timers like me aren't what kids need, they need peers—other kids to help them—to talk—to enthuse—to share excitement.

How in hell are we going to do all that? Well, it's not as hard as you may think. Yes, of course it can be done—done despite all the lame excuses about kids being attracted to computers these days. Sure they are—they have computer clubs in school—and they visit each others' homes and play with their computers. They talk about computers—read about 'em—they play games, they program and swap programs. They break the protection on programs and swap them. They get on the phone and break into bulletin boards—into banks—into military base computers. Talk about fun!

Amateur radio has every bit as much excitement as computers—and I've done the computers bit too. Computers are fun, no question, but they're no competition to working a rare DX contact—making a DX aurora contact on two meters—getting a new country via OSCAR—working a new state on 10 GHz from a mountain—operating in a DX contest—getting a good picture on an SSTV screen from a new country—visiting 9B1MM in Katmandu or 9M6MO in Kota Kinabalu in person—working South Africa with a 2m handie-talkie through a crossband repeater—getting a call on 20m from King Hussein—working Arthur Godfrey on safari in Africa and saying hello to an old friend of my father's who was with him.

I remember a 1946 night—after a college radio club meeting when a bunch of us got into my old '41 Ford and drove to the top of Mt. Greylock in nearby Western Massachusetts. We had my SCR-522 and a 16-element beam on top of the car and had a ball. It was bitterly cold, so we set up the beam and turned it with a couple pieces of string running out the car window. Huddled around the 522 in the back seat, we worked dozens of stations—all the way to Boston!

Newspaper articles about our ham activities will help strike a spark of interest in kids, but without school ham clubs to follow up, it's a waste of time. Sure, we need PR in magazines, newspapers, on TV, radio . . . every medium. We need to demonstrate in shopping centers and malls. We need to provide communications for parades, rallies, and other community events. But most of this will be wasted if there isn't the follow up—the school clubs.

Okay, we need to rebuild the high school ham clubs. That'll get the kids in the 14–17 age bracket. Back before the ham dark ages—back in the 50s—ARRL studies showed that 50% of the new hams were either 14 or 15 years old. That's when it happens. I think we can start as early as ten these days, and I'm working on a fiendish plan for that. In the meanwhile let's go with what worked so well for 17 years after World War II—hooking the high school kids. Let's talk about getting high school ham clubs going again—rebuilding the infrastructure which we know worked so well.

It won't be as hard as you think. Better, it will be more exciting—and also more frustrating—than anything else you've done in amateur radio. Your first obstacle will be the resistance of the members of your own radio club. People in general and hams in particular tend to do everything they can *not* to change—often in the face of overwhelming evidence that change is not just necessary, but critically important. People in general and hams in particular are terribly lazy. They will go to incredible extremes not to do something. This is human nature and, contrary to most evidence, hams *are* human. Well, some are.

Let's not get into what hams are. Most of 'em are obviously crazy. Most are cheap bastards. I admit to both of those ham normalities, so I'm not throwing stones, just calling a spade a spade. I think, by almost any measure, any ham in the ham industry has to admit s/he is crazy. There's no other rational explanation for such irrational profitless behavior.

My recommendation as to the easiest way to get ham clubs started in schools is to encourage our community ham clubs to get going on this as a club project. A small delegation from the club needs to talk with the school principal and explain the importance, to our country and to the kids, of getting them interested in a high-tech hobby such as amateur radio.

The next step is to start regular meetings—maybe once a week—preferably during school hours, if at all possible. Get the principal to allow a club meeting in lieu of a study hall. After-school clubs are often up against serious problems such as busing and sports conflicts. If you can't get a school period, then settle for after school.

The principal will quickly remember that a club has to have some sort of faculty advisor—and that means, particularly after school, overtime pay, which isn't in his budget. If your club can guarantee that it will supply an advisor, you may be able to handle this hurdle. The incipient hams will need someone to tell them about the glories of hamming—and perhaps organize theory and code courses. It's an opportunity to get the kids to come to the community club too—and even to visit local ham stations and maybe get fired up by talking with some DX.

If the principal isn't too interested, you may be able to work through a child or grandchild of a club member attending the school.

If you run into a particularly tough case you might point out that the lack of young radio amateurs has resulted in America falling far behind in engineers—with no growth in engineering graduates in over twenty years despite over a ten times growth in electronic sales. This is why Japan has been able, one by one, to take our consumer electronic industries away from us. Only by getting kids interested in high-tech careers will our country be able to reverse this destructive trend—and that means starting high school kids toward careers in electronics, communications, and computers. Every school in Japan has an active ham club.

Let me be blunt—I don't know for sure that we can pull this off, but if I wasn't pretty damned sure, I wouldn't waste my time trying. I don't have a record of failure—and I don't intend to break that record now. If you really believe I

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R.I.P. POOR LRPC

One of the reasons I've been so concerned over the shortage of new hams has been my work with the FCC's Long Range Planning Committee. I was appointed to the committee when it was formed five years ago and, despite its meeting in Washington, I don't recall having missed more than one meeting in all that time.

The purpose of the committee was to tackle America's need for an emergency communications system which could be expected to survive even the most serious of emergencies...a nuclear attack. It became obvious early on that our commercial and military communications systems were totally inadequate for this need. The committee recognized that only amateur radio had the potential.

However, amateur radio had only the potential for this, not the actuality. The volume of communications which would be needed should there be a nuclear attack is so far beyond the present capability of amateurs to handle that we are almost worthless right now. The millions of messages involved can't possibly be handled with our cumbersome, slow Morse-code traffic nets or even phone traffic nets. You know, it's estimated that 80% of us would be unable to pass a code retest if one were given.

Remember that any serious emergency wipes out telephones. Remember that most commercial communications services are on different frequencies and are therefore unable to intercommunicate. We've seen many times where only amateur repeater groups have been able to provide the interconnect between police, fire, ambulance, and other services.

The committee saw that any practical solution to the need would entail two major changes. First, we would have to get amateur radio into vigorous growth before we could expect to have enough hams to provide the needed service. Second, we'd have to get hams to develop technologies such as RTTY and packet radio far beyond where they are today to achieve the message throughput needed. The committee also recognized that for an emergency communications system to be dependable it must be in everyday use.

The FCC commissioners appreciated the serious need for amateur growth, but the only move which seemed to have any real prospect for bringing about this growth was the no-code license. This had worked exceptionally well in Japan, bringing enthusiastic teenagers into amateur radio by the hundreds of thousands.

When the ARRL fought the FCC's proposed no-code license and defeated it, the FCC, with no other known options for producing new amateurs, gave up in disgust. They dumped the LRPC on FEMA, the Federal Emergency Management Authority, which, as I predicted, completely ignored it. FEMA never held one single LRPC meeting in two years. The FCC recently dusted off what was left of the LRPC and held what appeared to me a brief wake, pronouncing the committee a rousing success, complete with a nice plaque and an autographed photo of Ronny for retiring Defense Commissioner Mimi Dawson. Mimi certainly gave it a fine try and did the best she could under the circumstances—a bravo to her.

Perhaps I should share the apparently common feeling that the situation is totally, completely hopeless, so why bother to waste time trying to fight it? Well, I don't think it is hopeless as far as getting amateur radio growing again. I even think, with *73* helping, we may be able to develop the high-speed automated digital message system we need. Heck, we already have the technology; all we need are the pioneers to work out the details and battle old-timer inertia to get it accepted. If we can get growth through kids, we'll have our pioneers.

But you tell me. Should I give up trying to fight amateur apathy, the ARRL, the FCC, and City Hall? Maybe you'd rather read about my misadventures on 20 meters. After all, the chances of a nuclear attack are almost zero anyway, what with the promised nuclear winter effect which would wipe out most of civilization. Amateur radio, as bumbling as it is, can usually cope fairly well with small localized emergencies such as earthquakes, floods, and vol-

canos—so why bother trying to develop more hams and a better communications system?

And, as far as getting amateur radio growing so America can generate engineers, technicians, and scientists so we can compete with Japan, perhaps it's time America got used to being a second-rate country—the way England has. Maybe we shouldn't bother to try and regain our former pride in our technology. It's so much easier to just let our kids enjoy drugs and television—to ignore their smoking cigarettes and spending their nights cruising. Recent statistics show the average American youngster spends an average of two and a half minutes alone with his father a day without the TV set on. Do we even care about our kids—about our country—or amateur radio? I see no evidence of anyone caring.

What do you think? I don't want to turn into a pest.

OUR HAM POPULATION

With a little over 400,000 licensed amateurs, we have a fairly strong hobby, eh? Of course we're seeing an increasing loss of newcomers, but the new ten-year licenses make it so the total number of licensed hams has stayed about the same.

What about concerns over the average ham age now reaching 56? How did that happen? I talked with an old-timer the other day who had an interesting perspective. He runs a ham store and he's observed that a surprisingly high percentage of the aging licensees are the wives and close friends of hams who were given or virtually given their licenses twenty-five years ago when that was popular. These Techs, now in their 40s and 50s, have never had enough interest to bother learning much about amateur radio, or to be particularly active. A more realistic guess at the even remotely active ham population might put it below 200,000.

The bright side: Most licensees who drop out each year are from the inactive half of the ledger. We're also losing an increasing number via Silent Keys, as the average age increases. Remember, the average life of men in the U.S. is around 72 years—which means, as I've pointed out before, by the time you're 72 half your friends will be dead and the other half dying.

We do have enough time left, however, to get busy and Elmer local school radio clubs so we can get amateur radio going again. Yes, I've heard all about computers taking the kids away from amateur radio. Baloney. Kids have always had plenty of interesting things to do. If hamming is fun we can interest kids in it. But we do need the school radio clubs to fan that spark of interest and get 'em licensed.

These days, with packet radio growing so fast, we have even more to talk about to kids. Packet is a way for them to use their computers and do something really fun with them.

I hear whines about kids not having the money it takes for amateur radio equipment. Heck, if kids can support a $100 a week cocaine habit, they should be able to put together a whopping ham station just by avoiding drugs. Any kid that really wants to can find after-school work and make money.

Speaking of money, what about the poor old-timers who are living in poverty on Social Security? I don't know about where you are but around here it's tough to find people for the available jobs. There's plenty of part-time work—and an unlimited number of ways for people to get into business for themselves.

So let's not be complacent, smugly assuring ourselves that we're 400,000 strong. Let's get to work rebuilding our hobby—getting youngsters. My goal for us is 1% of our population—yep, 2.5 million hams—over ten times as many as we really have today. If you get started with school radio clubs, I'll publish the simple construction projects and news of exciting new ham activities such as packet radio. Who knows, we may even get America back into high technogy!

GOD WILL PROVIDE

A few years back...oh my, it was 1966, twenty years ago...I visited Robbie 5Z4ERR...he used to be VQ4ERR when Kenya was part of the British Empire... which was then known as Great Britain. I suspect the term today is generally used in irony. Anyway, Robbie, who had been writing for *73*, suggested it would be nice of me to visit Kenya—and maybe go on a hunting safari.

I'd just read a book on how to go on an African Safari for $690. I checked, and sure enough, I had $690 burning a hole in my pocket. Should I start a new magazine or go on safari? Easy choice. I wrote an editorial in *73* asking if there were any hams interested in going with me on safari. It turned out there were two, so we did it.

No, I'm not going to write a day-by-day account of the trip...at least not now. What I'm gradually getting around to has to do with Kenya at that time, just a few years after gaining independence. Robbie, a British chap, ran the largest drug store in Nairobi—and had the biggest signal out of Africa. Oh, we had a lot to talk about!

After the $690 safari, which was most successful, thank you... while my trophies were being cured and shipped back... Robbie and I drove to the Serengeti game park for a few days. Robbie explained that one of the big gripes in Africa at the time was the attitude of the missionaries. The Europeans could see that what little they'd established in the way of civilization was unraveling, so they warned the missionaries to get out while the getting was good.

No, God Will Protect Us, they pioused. So then, when the blacks, caught up in *Uhuru*—freedom—started raping and killing, the cries of anguish arose—oh woe, please save us. Robbie was griping that then people had to endanger their lives to rescue these turkeys.

I tried to explain to Robbie that the inability to cope with an impending disaster is a human trait, not one isolated and perfected by missionaries. Oh, they saw the danger, but they just didn't believe it could happen to them. They really believed that God would somehow spare them, so they were very upset to discover that God helps those who help themselves—perhaps a new concept to them.

This came to mind as I thought about the similar reaction of businessmen. When the cash gets short they look around for temporary expediencies, some of which can have devastating consequences. How many times have I called *73* advertisers to see what they're planning to run, only to be told they're short of money right now, so they're going to cut their advertising. None ever survive.

Yep, I know this seems self-serving—after all I'm selling advertising space, right? Yes, I am...but more important to you, the reader, and to the industry, what I'm selling is one of the most critical aspects of any business—communications with customers and potential customers. No customers, no business...so when the connection to sales is cut, the business dies.

Most of the ads in *73* are run by small ham-owned companies. They're spending a bundle on ads in *73* in order to reach you, hoping desperately you'll buy their products. Few of them (any?) know much about advertising, so you'll see some terrible ads in amongst the few good ones. Rather than just skipping over the bum ads, you might take pity on a fellow ham and drop him a note explaining your reaction. Maybe he'll do better as a result.

Unless you're very unusual, the day is going to come when you and a ham friend or two get to talking about getting into the ham business. You'll have some gadget or some service and you'll want to give it a try. What could be more fun than being in business selling a ham product or service? Well, if you ask those who are in the business, you'll find there are many things far more rewarding—like jumping naked into a pit of hot tar.

Entrepreneurialism is a mental deviation which is generally more concentrated with only- or first-children, but can hit almost anyone. Hams seem particularly susceptible to this aberration, so watch out. One of these days you'll build some gadget which your ham friends will want. Will you make one for them? The next thing you know you're running small ads in *73*. Then bigger ads. Then full pages. Then the sun spots fade away and so do sales. Instead of advertising smarter you start cutting ads...dum de dumm dumm.

When sales are good you don't worry about making your ads work better—about getting the most out of 'em. When the hard times come it's too late to do the learning you should have when you had the money. Pity.

I can hear my telephone ringing now—I'd like to get into the ham business—how can I find a product to sell? My first warning is not to try to sell to hams—a tight-fisted bunch of retired old men bent on making sure newcomers suffer just as much as they did to get their ham ticket. Well, most of 'em are that way, but we do have a few hams interested in new things—or else we wouldn't have several thousand packet-radio enthusiasts. Perhaps there's some hope yet.

My own formula for finding products to sell is to make an annual pilgrimage to where most of

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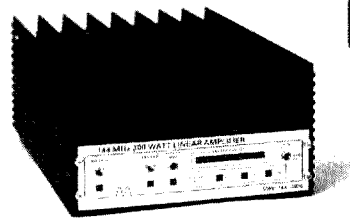
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the new products are being invented and developed: Asia. I try not to miss the Japanese Consumer Electronic Show every October (there are generally a dozen or so hams on the fall show tour), plus CESs in Korea, Taiwan and Hong Kong. They're one after the other. I'm importing some great electronic gadgets from Asia that I've discovered on these trips. For instance, we're selling about 500 Apple disk drives a month and a couple thousand swivel bases for monitors with power switching and protection built in.

The entrepreneur will find inspiration almost anywhere. I'll bet I come up with a gangbusters idea at least once a month, with idea-ettes almost daily. Now that I've got my publishing and retailing businesses running fairly well, I'll be looking for coconspirators and investors to start more businesses.

You can bet that when cash flows glaciate, I'll be pumping out the PR and advertising, not cutting back on ads to save money. Every business runs into cash problems—it's part of the real world.

One piece of advice I give every firm consulting me: When things are going well it is time to invest in a good PR person and a writer. I know of many multi-million dollar firms which would be going strong today if they'd had such a team on hand when the going got rough. Many firms with excellent products and services went out of business for this lack.

Am I being a nudge about you're getting into business? I guess I let my enthusiasm get away from me and write too much about it. I just get so darned fed up at hamfests hearing people plead poverty—poverty in the midst of plenty—plenty right there for those with the guts to go for it.

I wonder if there is any correlation between hams who try new things—who get involved with packet radio, who get enthused over OSCAR contacts, who get on 2m SSB—and being adventurous in life...in business? Seems to me there might be. Some hams get their Tech ticket and spend their declining years talking over a repeater—never really saying much. Some are into DXing, then into high-speed CW, then having a ball with slow scan. They never get bogged down for long.

One of the great charms of RTTY has always been the opportunity to talk with the more interesting and adventurous hams. The packet crowd is now saying the same thing. Plus, we seem to be able to communicate better in writing than we do on voice. These activities which take some extra effort are a fine filter to block out the boring turkeys. No, it isn't perfect, but it's good enough to keep most of us going on RTTY and packet well beyond our pioneering days.

Now, getting back to the God Will Protect Us syndrome—I see that same attitude—the same blindness to approaching catastrophe—on the part of our lower-intelligence old-timers. Here we have a hobby which depends totally on the use of incredibly valuable radio spectrum, a limited resource worth billions of dollars to commercial interests. We're an aging and shrinking group. We know that virtually all the technical advancements we used to contribute came from younger hams, yet we've allowed this resource to be almost wiped out. It's been a generation since we've done anything of value to warrant our use of our bands. Indeed, by keeping out the young experimenters we're now using only a few of our allocated bands at all. Will prayer save our hobby? Let's either get those prayer wheels going or get cracking on helping ourselves by getting school radio clubs going. Perhaps if we set all of our computers offering prayers 24-hours a day to save amateur radio from our own neglect, we might be able to relax and rag-chew without that guilt feeling. How about it you software chaps, have you a program which will take care of this for us?

DO YOU WRITE?

I'm looking for some columnists to keep us up to date on what's going on in the dozen or so related hobbies we call amateur radio. We're covering some okay, but not enough. For instance, perhaps you're a true 160m fanatic—fine, you'll have a lot more activity on 160 if you let everyone know what's happening there and how much fun it is. We're interested in antennas, 160m equipment, contests, special events, band conditions, what DX is available on what frequencies, when, and so on.

If you're an 80m guru, we're interested in the same info—monthly. We're also interested in special activities such as RTTY, high-speed CW nets, and service nets. There's a lot going on on 80. Is there anyone who can tackle it?

Ditto the above for monthly reports on 40m, 20m, 15m, and 10m. In addition, if there's enough interest, we might have a separate 10m FM report. I don't know if there's enough activity on 6m to fill even a one-inch column, but if there is someone who lives and breathes six meters and can fill us in on what's happening there, let's hear from you.

There is so much doing on two meters I don't know how we could cover that. If there's someone with the guts to try, I'd like to hear what you propose. Trying to cover voice repeaters, RTTY repeaters, digipeaters, moonbounce, meteor scatter, SSB, CW, aurora...I don't think it can be done.

220 is easier—any volunteers to see what can be done about making 220 more popular? We need repeater lists, simplex channel data, contest information, equipment news, and so on. Perhaps we need a 220 contest?

430 is a busy band in many areas of the country, with some TV on the low end and a passel of repeaters higher up. Is much being done during contests? Simplex? Mountaintopping? Moonbounce? Spread spectrum? Is there a volunteer?

1250 MHz—volunteer? There's more and more ATV here, EME...and what about microwaves—like 10.5 GHz, 24 GHz, and so on? Is there a volunteer with enough interest to try

and get more activity on these bands? We need to know what's being done, what new equipment is available, how the bands do during VHF contests, and so on.

We need a column for SSTV. And how about high-speed CW—anyone into that who can tell us what's going on—where to listen—what equipment to use? EME. . . volunteer? We have OSCAR orbits, but how about news?

We have an estimated 150,000 American hams who are actually active in some way. Most of us are creatures of habit. We get stuck rag-chewing on 75 meters and tend to forget the fun of climbing a fire tower on top of a mountain in the middle of a well-below-freezing night to try for a 10.5-GHz contact with a new state. Some fun. So if you are having a ball with some aspect of amateur radio and would like to get more of us interested in your insanity, the best way to promote it is with a monthly column in *73*, telling us what's going on, how to do it, and how much fun it is.

Even though I'm as habit-frozen as just about anyone, columns and articles on ham activities I haven't yet tried eventually get to me. Over the years I've been forced by magazine articles and columns to become an RTTY fanatic, worked more than my share of DX, have a big certificate collection, have done my bit with 75m DXing, was a pioneer on six meters, have the record for states worked on 10.5 GHz, had my own repeaters on several bands, operated SSTV from several countries, and so on. If you're enjoying ham radio, get more hams involved with your particular interest with a column.

If you'd like to give it a try, put together a sample column and send it to me so I can get an idea of what you can do. I'll pay modestly, but your main reward will be increased interest in your activity. I prefer to get both a disk and a printout so we won't have to retype your material. We're completely automated these days, so we plug your disk in, edit your stuff, then feed it right into the typesetting system.

I'll be judging your columns on how much you obviously know about your subject, how persuasive you are, and how much you'll be able to contribute without depending too much on material from readers. As a hard-core stick-in-the-mud ham, one who tends to stay with what I'm doing unless dynamited into something else, I'll be looking to see if your column gets me to thinking about giving your interest a try. It won't hurt for you to include an outline of things you'd like to cover in future columns.

I got stuck for about a year talking to the same bunch of hams on 75m one time. It wasn't until the excitement of six meters opening to Europe during a sunspot high that I broke away. The enthusiastic articles and reports finally did it, getting me to convert an old FM radio to see what the fuss was about. WOW!

In order to keep columnists on their word processor keys, I want all of you to send me a Feedback card (page 80) every month telling me how you rate 'em. If they lose out in the ratings, I'll look for someone you'll like better. It's all too easy for columnists to run out of material and get dull. There isn't any excuse for dull in a bunch of hobbies like ours.

I don't know whether we'll get you going on high-speed CW, on EME, or what, but I'm going to do everything I can to get you off dead center. If you aren't an expert, at least contribute your news to the experts. . . and help me get as many hams subscribed to *73* as we can. Talk it up, okay? It's better than reciting your ham gear serial numbers.

ASIAN TOUR

The Consumer Electronic Shows in Japan, Korea, Taiwan, and Hong Kong are back to back in October, making it possible to get to all four in a two-week Asian trip. It's a fast tour, with one-day travel and then two days in most countries, but it gives you a chance to both see these interesting countries and get to their electronic shows.

Compact disc fanatics will love the wide variety of CDs available in Japan and Hong Kong—thousands of CDs which aren't (and may never be) available here.

One of the nice aspects of this show tour is your freedom. If you want to go to the electronic shows, you'll have a bus and all the help you need. If not, there are sightseeing trips. Or you may want to go it alone. I've been going on the Commerce show tours for about eight years and find them invaluable for making contacts and keeping abreast of all electronic technologies.

The tour leaves the U.S. October 2nd from most any city you want, flying to Tokyo. You arrive the 3rd and are transferred to the New Takanawa Prince Hotel—a fine new hotel in the Shinagawa district of Tokyo. Several of us will be having dinner that first night just down the street in a great little (and surprisingly inexpensive) tempura restaurant.

The tour provides a first-class breakfast every morning—plus at least one banquet dinner per city visited. The breakfast is a fine time to meet your fellow tourers. The tour usually has between 150 and 250 people, including a dozen or more hams, so it takes a while to meet everyone.

The hotel is located right near the Shinagawa station, making it possible to get almost anywhere in Tokyo in minutes—such as Akihabara, where there are hundreds of electronics and parts stores. There's even a Baskin Robbins and a McDonalds across the street from the station, in case you get a yen for American fast food.

On the 6th we're off to Korea and the Seoul Hilton, which is near the famous Etweon shopping district. Between sightseeing (like the historical Korean Village), the electronics show and visiting electronics factories, there's plenty to do during your two days in Korea. We'll join the *73* Magazine® DXpedition group here, where their tour begins.

Next stop is Taiwan on the 9th. If you didn't get a new suit in Seoul, you'll probably buy one here. By the way, though the yen has seriously escalated in price, currencies in Korea, Taiwan, and Hong Kong have held steady, so these are still first-rate shopping countries. Tailor-made suits are around $150 here—shirts $8. They can measure you the evening you arrive, make the first fitting the next morning, and have the finished suit for you that evening.

The Taiwan electronic show is always a big one, with hundreds of small businesses showing products of interest to importers. I've been importing a bunch of computer accessories from Taiwan, so I'll be looking for new ideas.

Yes, there's sightseeing, factory visits, an incredible place called Snake Alley—but most important for me—we'll be in Taiwan on October 10th—10-10, the biggest holiday of the year—so we'll be able to visit the huge stadium and watch the kids perform. I'll have my 8mm video camera along this time and tape the whole production. You have to see the show those kids put on to believe it.

Then on to Hong Kong. Here, in addition to the fun of the city, you'll find your best shopping for cameras and electronics gadgets—plenty of record stores with wide CD selections—bargain portable CD players. If you bring along your 2m HT you can get a ticket here and operate on the seven repeaters.

There are side trips available to Macao XX, just an hour away by hydrofoil, or to Shenzhen City, for a peek into China BY.

After Hong Kong there are optional tour extensions—two days in Canton for the Canton Trade Fair, two days in Canton plus three in Beijing, where you can check out the Great Wall, the Ming Tombs, and perhaps get on the air from BY1PK, or two days in Singapore 9V1. If there's enough interest, I'll go on from Hong Kong with a small group for a short visit to the tiny countries of Sabah 9M6, Brunei V85, and Sarawak 9M8 on Borneo—an extra seven days—in case you'd like to see these fascinating, but seldom visited countries. I've been to all of them and they're well worth the trip.

How much does all this cost? The round trip economy fare from the West Coast, October 2–16th, to Japan, Korea, Taiwan, and Hong Kong, is $2,639. It's a bit more if you want to travel Executive Class—and a bit extra from the East Coast, of course.

For a full schedule of dates, costs, and details, drop me a note and I'll get 'em to you.

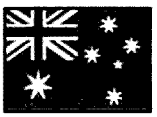
If you've added 8mm video to your repertoire, be sure to bring your camera and plenty of tapes on the trip. I've visited these cities a dozen times or more over the last 25 years and they're still fascinating.

You need visas to visit most of these countries. These take time to get, so you can't wait until the last minute and suddenly decide I guess I'll go on the trip. The China add-on takes even longer, with July 31st being the deadline.

About two-thirds of the people on the tour are repeat customers, so Bob Chang, the chap who runs Commerce Tours and personally conducts the tours, is doing it right.

Write Wayne Green W2NSD/1, Asian Tour, WGE Center, Peterborough NH 03458.■

73 INTERNATIONAL



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

VK6 INFORMATION

With the number of overseas visitors coming to the America's Cup Yacht Race in VK6 later this year, I have received several letters seeking information regarding amateur radio in VK6. Particularly needed was info on 2 metre and 70 cm repeater operation. I hope the following will assist these people in having an enjoyable stay in West Australia for the Cup.

Nearly all VHF-FM repeaters in Australia have a downwards shift of 600 KC [kHz] on transmit; e.g., Perth VK6RAP: receive on 146.700, transmit on 146.100. As not all repeaters are in operation at the same time, due to breakdowns or off-air being serviced (and as I am over 2,500 miles away on the other side of the continent), I cannot guarantee which ones will be working during your stay. However, here is a full list, to my knowledge, of VK6 repeater frequencies in Perth, for you to either program your sets, or bring the appropriate crystals:

RAP–146.700 (Voice)
RTH–146.750 (Voice)
RTH–146.800 (Voice)
RPD–146.950 (Voice)
REE–146.975 (Emergency)
REE–147.000 (Emergency)
RTY–147.050 (RTTY)
RWC–147.100 (Voice)

There also is one 70 cm repeater operating in the Perth area on 438.525 MHz.

PEOPLE TO CONTACT

If you wish to contact a radio club either when you arrive or beforehand, I would recommend the Perth Radio League of WA (Inc.), PO Box 106, Cannington, W.A. 6107, Australia.

As stated in previous articles, the best way to gain a reciprocal license in Australia is to apply upon arrival. In Perth the place to go is the Department of Communications, Caga Centre, 256 Adelaide Terrace, Perth 6000; Phone: 09-3255877 (within Australia).

NOTE: American Novice licenses are not recognized as valid for a reciprocal license within Australia.

The cost of a license, regardless of length of stay, is A$23. [US$1.00 about A$1.40 as of April.] If you wish to apply for a license beforehand, please write to State Manager, Department of Communications, PO Box 6189, Hay Street East, Perth 6000, Australia. All that is required is either your original amateur license (or a certified copy) to show to our D.O.C. You will then be granted a similar grade license with a VK callsign for 12 months operation within Australia.

RAOTC

In 1975, a small group of Australian amateur radio operators decided, mainly under the guidance of Bob Cunningham VK3ML, to form a Radio Amateurs' Old Timers Club, the main criterion being the holding of an amateur license for at least 25 years.

From this small beginning there are now over 750 members, with some members being classed as old old-timers, having held a license for over 50 years.

Between 1975 and 1985, club communication was via weekly on-air skeds and a newsletter. With the growing membership, it was felt an annual magazine was required to service its members. 1985 saw its inception with Max Hull VK3ZS its editor and Kevin Duff its co-editor.

The magazine itself is full of nostalgia, with listings of present members, plus later day silent keys; with the band conditions the way they are today, it is the only way some of the not-so-active old-timers get to know of a friend's passing.

The story below (by Lay VK3CF and Bill VK3CB) is typical of the magazine, and should bring back memories to some of the earlier days of amateur radio when experimentation was supreme.

The Big Re-Broadcast

During the 1928–30 period in Melbourne, when a selected number of amateur stations had permission to have "fun and games" on the broadcast band, there was much friendly rivalry between the boys to see who could come up with some novel programme to augment the playing of gramophone records.

One (big deal) for those days was to re-broadcast an overseas shortwave transmission or to introduce local "live" talent from Mum's front room, using it as a sound studio with a "Reiss" carbon microphone made from a marble block carved out by the local tombstone people plus pieces of mica and lots of carbon granules. I was Bill Sievers' (VK3CB) second op—and how Mum Sievers put up with us hanging chaff bags and hessian from the picture rail right around the room to reduce reverberation (yes! we knew something about acoustics even then) and pinching the four-inch wooden curtain rings from the spare room to make our multi-strand sausage-shaped zepp aerial, I'll never know.

An amusing highlight of those days happened to the late Bert Maddick VK3EF of Elwood. He had his talking cockatoo in the shack with him, and while transmitting, the bird let loose with profanity that would have done justice to a bullock driver at his best! However, Bert was let off the hook by the Postmaster-General's Department, but only after a severe reprimand. Enough said!

One of the best outside broadcasts (O/Bs) was put on by Arthur Forecast VK3AM who arranged with his second op, Headley Myers (the "Igranic" wireless man at Noyes Bros.), to receive the powerful American station KDKA, owned by the Western Electric & Manufacturing Company, from East Pittsburg, Pennsylvania, at his QTH and then, with special permission from the Department, send their programme down the telephone line to Arthur. This was technically and otherwise very good, and it created a lot of interest until one evening the local telephone exchange operator, being unaware of the Department's OK for this activity (so what's new?) heard music on the line and immediately put on the howler which caused Arthur's many listeners to imagine that their receivers were about to blow up!

The late Stan Gadsen VK3SW, Ivor Morgan VK3DH, and the Hoist brothers, VK3BY, and many others were very active in those days, and last but by no means least, VK3CB and myself. I started out in the "OA prefix" days (prior to the VK prefix) as Bill's second op.

Not to be outdone by the aforementioned weekend amateur broadcasts, we let it be known one weekend that on the following Sunday night at 11 p.m. we would re-broadcast a programme from JOAK, Japan. This station could be heard on the BC band on a slightly higher frequency than 3LO when the latter closed down at 10:30 p.m., as did all the BC stations in those days.

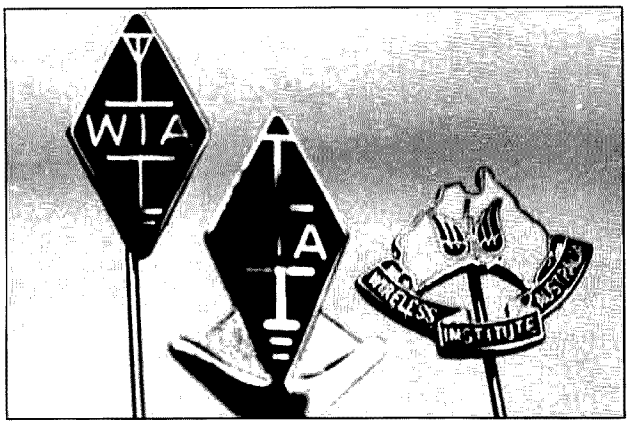
Normally we could receive JOAK at good strength at East Richmond, but on the Saturday night prior to our much publicized "Big Re-Broadcast," my multi-tube receiver packed up and in no way could it be fixed up in time for the following night's "do." After the first wave of panic subsided, we dreamed up an idea to get us off the hook: in fact it was a stroke of genius! We announced on the Saturday that due to matters beyond our control, we could not relay the Japanese station but, as an alternative, we would do a re-broadcast from China and thus keep faith with our listeners who were patiently waiting for the overseas broadcast.

Bill and I now applied our true amateur talents! We had no idea at all of the existence of a Chinese broadcasting station, so we created one ourselves! Firstly, Bill managed to fit a switch which would reverse the direction of rotation of our gramophone motor while I arranged our Webster pickup arm to track from the inside out. We then drilled a new spindle hole about 3/4" off centre in an old 10" disc on which was recorded mainly voice. This was placed on the turntable using the off-centre position for the spindle and, after the big announcement of the "Big Re-Broadcast" from China, the thing was played off-centre, inside out, and back to front!! Talk about a Chinese broadcast; it was perfect! The secret of a nonexistent foreign broadcast has remained with us. . . until now!

I am grateful to VK3CF and VK3CB for the above story!

WIA BADGES

For nearly half a century or more, the WIA has had the same lapel badge featuring Australia over a banner of the WIA, but with the ease of international travel, some of the members voiced a need for an international-type lapel badge, with the familiar diamond shape being mooted. This



The Australian badges. L to R, new, newer, and old.

diamond-type badge was manufactured, with quite a few being bought by members.

This, of course, brought howls of indignation from some older members saying, "We are losing our National identity!" The arguments raged back and forth, with the result being that a third badge was made featuring the diamond shape plus a boomerang. The idea being that the diamond was for easy international recognition and the boomerang depicting Australia, with the added bonus that it was simple matter to have your callsign inscribed upon the boomerang; this badge would serve a three-fold purpose.

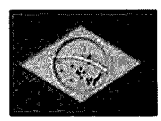
The arguments are still going strong with some members, as to which badge is the most representative of the Australian amateur. Photos of the three badges are included to help you form your own opinion!

SPICE UP YOUR QSO WITH PHRASE DROPPERS

Ever noticed how your QSO becomes a little light on technical conversation? Well, try a few of the combinations in Fig. 1 next time and no one will ever admit that they don't know what you are talking about! Select any three of the phrases, such as 3, 7, and 9, which give "parallel incremental consistency." Maybe your transceiver just fits the bill.

0. integrated	0. muted	0. options
1. total	1. organizational	1. flexibility
2. systematized	2. monitored	2. capability
3. parallel	3. reciprocal	3. mobility
4. functional	4. digital	4. programming
5. responsive	5. reactive	5. concept
6. optional	6. transitional	6. time phase
7. synchronized	7. incremental	7. projections
8. compatible	8. overtone	8. hardware
9. balanced	9. emissional	9. consistency

Fig. 1. An extract from the VK2 Westlakes Amateur Radio Club's Monthly Newsletter, April, 1982.



BRAZIL

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Brazil

WWSA CW 1986

Last year's changes in rules for the World Wide South American CW Contest brought very interesting consequences and results—a strong increase in participants being the immediate response. (See "Contests" in this issue.) Simplified purpose, contacts between stations in all countries, seems to be the best to everybody, considering we had almost double the radio amateurs from all parts in 1985.

As contest period annually is every second complete weekend of June, from 1500 UTC Saturday to 1500 UTC Sunday, this 1986 it starts June 14. Keep an eye on that second and complete weekend! Bands are 1.8, 3.5, 7, 14, 21, 28 MHz, and crossband contacts are not valid .

Classifications—2-way CW mode, only for (1) single operator, single band or all bands, (2) multi-operator, single transmitter, all bands, (3) SWL. Call will be—CQ SA TEST.

Exchange—RST/QSO number starting from 001.

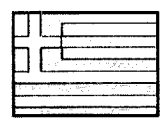
Points—Each QSO in same country 0 points (valid only as multiplier); in same continent, two points; in other continents, four points. Only for DX stations, QSO with South American stations, eight points!

Multipliers—all different countries (DXCC list) and different South American prefixes worked in each band.

Scoring—final score is the total QSO points multiplied by the sum of total multipliers from all bands.

Certificates will be granted to three top-scoring stations of each class in country, reasonable score provided. Results of South American entries will be listed separately from other continents.

A separate log for each worked band must be sent not later than August 31, 1986, and PSE follow standard international contest logging rules! Send to WWSA Contest Committee, PO Box 18003, Rio de Janeiro, RJ, Brazil 20772.



GREECE

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Box 23051
Athens 11210
Greece

In one of my previous columns I had mention about a new repeater (RØ) on top of Taigetos Mountain, and I promised to return to it with more details. The reason is this is the first Greek repeater under solar power and also under remote control. Of course this might look like a common situation for countries with a lot of amateur population, but for our country I shall call the event as unique.

The man behind this installation was John SV1KC, an excellent electronics engineer who has put all of his talent on writing the software but also designing and building the hardware for the control of the repeater.

The repeater's site is on a place called Ag. Panteleimonas, 1640 meters above sea level in South Peloponese. Because of the high altitude, several parameters had to be met before everything was ready for the top.

Now what the hardware contained was a Yaesu receiver and transmitter, an RX-TX systems duplexer, a colinear heavy-duty antenna with four dipoles, three starved electrolyte batteries, and three photovoltaic panels from B.P. (British Petroleum). The repeater was designed with two power levels (2.8 and 8 W), and every two hours is giving telemetry with information about its status.

The full message is transmitted every two hours and looks like this: VVV CQ CQ DE SV3A ...CHRG...AH DICH...AH TEM IN...DEG TEM OUT ...DEG BAT CAP...AH AR.

CHRG gives charging current for the last two hours, DICH gives power consumption during the past two hours, TEM IN gives inside temperature, TEM OUT gives outside temperature, and finally BAT CAP gives battery capacity. Along with each transmission RØ sends a subcarrier of 72.8 Hz for monitoring service.

The receiver consumes only 14 mA squelched, and power output is dependent on the capacity of the batteries (more on this later). Both receiver and transmitter are using ovens for the crystal oscillator in order to keep temperature between 25–30 C. There is also a clever system into the receiver called "economizer" (Yaesu uses this in FT-209 handheld). With this system, the receiver if is not triggered for 10 seconds then goes to 9% duty cycle receive (90% off and 10% on) preventing spending energy for no reason.

I think that this is enough for the hard part of the repeater. In my next column I will look a little more inside SV3A's logic and will reveal all the power that a soft control can give to an ordinary repeater.



HONG KONG

P. J. Weaver VS6CT
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91 Leighton Road
Hong Kong

I am scheduled to leave here on May 12 for my triannual leave and will be visiting with friends in Cali-

fornia, Oregon, and Illinois until June 15. Then I head for Miami and hope to join a 48' DeFever motor cruiser for a six-week cruise around the Bahamas and Exumas Islands. Subject to confirmation, I then hope to spend August in the U.S. Virgin Islands, perhaps operating as VS6CT/KP2, which will be bound to attract some attention! I will then be in the New York area for a week or two before going on to England in mid-September. I am due to return to start work here on October 15.

I had a most interesting five-day trip to Okinawa to visit the Western Pacific Search and Rescue Center. It was mainly a familiarization trip to learn how the other half operated, as we work very closely with that organization when there are any search-and-rescue operations going on in our region. Another seminar in Singapore in April is being put on by the International Maritime organization, but we will have to sing for our supper there. I am busy now preparing a paper to present, on how we do our search-and-rescue operations here, and the facilities we have. After Japan and Okinawa, Hong Kong is considered the most effective operation in the far east, and we have been asked to show other ASEAN country representatives how we do it.

Amateur radio in Hong Kong is making very big strides at this time. At the moment, we have over 300 licensees of whom over 70% have the Class B license—they have passed the technical exam but did not have to take code. They are permitted to operate on 30 MHz and above, and of course that includes satellite operation. They are a very keen bunch, and since we implemented this license (for which I was responsible for achieving), there has been great interest among the local Chinese. Thanks to this no-code licensing, which is the same as in the United Kingdom, with the same exam, we have had a big expansion in activity. By October I hope we will have four more repeaters to add to our present three, and a closed repeater for the English-speaking hams only. One of our major problems with the increased activity is that repeater chatter is all in Chinese, and as an English-speaker only, I can do a lot better if I don't have to listen to a repeater pouring out a language I don't understand.

Had great fun over the Chinese New Year holiday in February, doing one of my expeditions to Macau. I made 2,700 contacts, well short of my average, but conditions were not the best, as was to be expected at the bottom of the current cycle. Expeditions to Macau are becoming more and more complicated, however. In the good old days, it was a matter of simply applying for a reciprocal license and getting on the air, either from an existing station which one had on loan or setting up in a hotel. The fee was US$3.50. Now it is US$17.50, plus US$25 if you ask the Post Office to do all the forms for you, on the ubiquitous Portuguese "Blue Paper," which is used for all legal matters. The license is valid for only 30 days, and after setting up your station you have to have it inspected before you can operate. All this has happened just recently; and I don't think I'll bother with Macau again, at least not unless I can use an existing station.

My best to Wayne. It will be delightful to read his editorials again and I am delighted he is back at the helm of *73*. I hope you will consider publishing short stories again from time to time. I have been amused by them in the past. Perhaps you could ask subscribers to contribute some which have a "ham flavor."

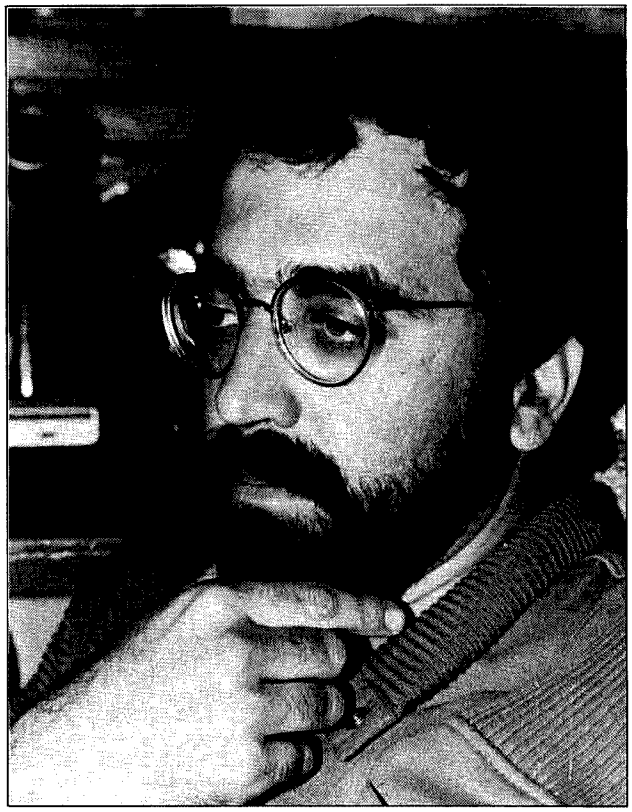


ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev M.P.O. 85530
Israel

An important precedent for amateur radio has been set in the Haifa City Court. Until recently, antenna lawsuits were troubles only to be read about in the American ham press, as far as Israeli amateurs were concerned. Now, after a short but tense court case, the hams here can breathe a sigh of relief, thanks to the refusal of Israel Lavie 4X4UF to bow to the pressure of his neighbours.

To supply necessary background, most Israelis do not live in detached houses, but dwell in apartment blocks which are the common property of the dwellers, each person owning his own apartment. The denizens elect a "house committee" which is responsible for the upkeep of the building, collects maintenance fees, and makes rules regarding the use of the common property.



Dov Gavish 4Z4DX.

A few years ago, 4X4UF, a ham of more than twenty years seniority and known in the amateur community for his technical innovations and construction of miniaturized transceivers, moved from the Galilee town of Carmiel to the city of Haifa. Not a big DXer, he satisfied himself with a modest dipole antenna on his building's roof. I suspect that most of his operating anyway was on two meters while driving to and from work.

One bright day, the house committee of his building decided that the black coaxial cable coming down the side of the building to Israel's window from his dipole was an eyesore, and demanded that he remove it. Gritting his teeth, as it were, Israel complied, but in order to partly compensate himself he installed a small two-meter beam attached to the railing of his balcony facing out from the back of the building.

Ancient Hebrew proverb says, "You give them a finger and they take the whole hand." One day 4X4UF opens his mailbox and finds himself served with a summons to appear in the Haifa municipal court, charged with defacing the appearance of the building. In the meantime, he removes the beam but photographs it for posterity.

Hiring a lawyer and accompanied by a few amateurs as witnesses, Israel appears in court and presents the photograph as evidence. The chief municipal building inspector says that to his recollection the antenna on the balcony was bigger, so the court adjourns so that the actual antenna in question could be examined.

In the course of the examination, it becomes clear that said antenna was not permanently attached to the building; it looks like that on these grounds Israel may get off the hook. However, in this case the right of the ham to his antenna will still be in question, and red-head 4X4UF, once challenged, does not back off.

There is no substitute for a smart lawyer, and, indeed, Israel's has been doing his homework. Checking the conditions of the license, the lawyer discovers that section 13 article 4 of the Israeli Amateur Radio License contains the following (which I have translated from the Hebrew):

"When there is, in the opinion of the Minister of Communications, a state of emergency, and the public welfare deems it neces-

sary, the director [of the Ministry of Communications] will be authorized to take charge of the station, to supervise it or use it for the needs of the State, without payment, or to transfer it to whom he sees fit, or to order the owner of the license to operate the station according to his instruction. The duration of this clause will not expire with the cancellation, correction or change of the license."

Armed with this important yet generally overlooked section of the license, Israel's lawyer, taking a more offensive posture, asks the judge, how, in the time of national emergency, can a radio amateur comply with the terms of his license and be of service to his country if his station has been rendered ineffective by the lack of an antenna? Indeed, in such times, the ham station is not an individual's means of personal entertainment, but a vital resource determined by law to be put at the nation's disposal.

It should be pointed out that this case took place when the memory of the vital service provided by amateurs at the time of the Mexican earthquake disaster was still fresh in the public consciousness, and, coupled with a year of excellent media coverage, amateur radio in Israel was riding on high waves of popularity.

Upon hearing this argument, the judge was convinced and the case standing against 4X4UF was dismissed. The amateurs Israel had brought to court did not even have to testify, and similar charges that were standing against another Haifa amateur were dropped.

What is the significance of this court decision for the Israeli radio amateur? This case was fought in a municipal court, so although directly affecting only the city of Haifa, should the right of an amateur be contested in other courts, an important precedent has been set.

In Haifa, any licensed radio amateur can erect an antenna on the premises whose address appears on his station license. A transmitting antenna does not require a building permit, and the Haifa chief building inspector has said that should he receive any further complaints, he will first consult with officials of the Israel Amateur Radio Club before deciding whether action should be taken.

Compared to the costs of similar legal struggles abroad, this case was a bargain, with legal fees costing $500. The Israel Amateur Radio Club put up $150 aid, and it is expected that Israel will receive enough donations so as not to feel any monetary pinch.

It is our hope that this will be the end of legal proceedings against ham antennas, and, naturally, a wish goes out from here that all amateurs worldwide will be able to defend their antenna rights with such relative ease.

At the time of writing Israel Lavie is not celebrating his victory with a monstrous multi-element tribander perched on his building's roof. However, his modest two-meter beam is no longer on the balcony railing but is on top of the building, and when he does manage to get on two meters, I'm told that his signal has never been better.

A TOP DXER

4Z4DX

One of the few Israeli amateurs to climb close to the pinnacle of the coveted DXCC honor roll is Dov Gavish 4Z4DX, who to date has confirmed 315 of the current 316 countries.

Brought up on amateur radio on Kibbutz Ramat David in the northern Jezreel Valley, Dov is the son of the late Israel Gavish 4X4VB, who passed away last year. With his wife, Anat, and two children, Dov today lives in Ramat HaSharon, ten miles north of Tel Aviv.

His back yard has turned into an antenna testing field, where it would seem that nothing less than a *very* thorough testing suffices. This is evidenced by having achieved on *five* bands, Worked All Zones (first in Israel), DXCC, and Worked All States—not a simple task from Israel. Other certificates earned are 160-meter DXCC, YL DXCC, Worked All German Countries, and 2500 U.S. counties certified in the County Award.

Inside his shack sit the Kenwood TS-930 and Drake TR4 plus the Robot slow-scan television outfit. The current antenna farm consists of a KLM 6-element tribander at 95 feet up, a 2-element 40-meter beam, and full-sized slopers and inverted vees for 80 and 160 meters. In the past he has tried different antennas for 80 and 40—delta loops, wire beams, slopers, and even a rhombic that he once stretched between four irrigation pipes on a once-vacant field adjoining his house.

Dov is also active in group activities, having found the club station 4Z4EX in Ramat HaSharon and organized the 4X6A multi-multi operation that took first Asia in the 1979 CQ World-Wide DX contest in SSB in which your faithful scribe had the honor to participate.

What's Dov's secret? If he has something special he isn't saying, but there's no doubt that the key is perseverance—listening on the bands with great concentration—good antennas, and a certain sixth sense that every serious DXer seems to develop.



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

RECIPROCAL LICENSING

Over the past year or so I have had a few enquiries from amateurs who intend to visit New Zealand regarding our reciprocal licensing arrangements. For those who may be interested I shall outline them again, more fully than on the last occasion.

Countries with reciprocal agreements with the New Zealand Government include Sweden, Switzerland, French Republic, United States of America, and the Netherlands. In addition, countries with Commonwealth recognition Include Australia, Canada, and the United Kingdom as well as a large number of Commonwealth and Pacific countries; countries with guest licenses include South Africa.

NZART, recognising the importance of this facet of our hobby, have appointed Russ Garlick ZL3AAA co-ordinator of the Reciprocal Licencing Bureau, and any enquiries regarding reciprocal licensing may be directed to him. He also keeps up with the information ZL amateurs need to know when they contemplate an overseas trip. The address for Russ is: Mr. R. A. Garlick ZL3AAA, 23 Lydia Street, Greymouth, New Zealand.

Here is a guide to the requirements for an application for a reciprocal license when visiting New Zealand:

1. Complete an application form in duplicate (obtainable from Russ or the Radio Regulatory Section, Post Office Headquarters, Wellington, New Zealand).

2. Supply with the application a photocopy of your operator's certificate and a copy of your current receipt for annual fee paid.

3. A certificate to indicate the Morse speed at which the applicant is qualified.

4. If no evidence of Morse speed can be submitted, the applicant may sit for the examination in the normal way. (Remember, ZL VHF operation is with a non-Morse certificate, so if you only want 2m or 70cm operation, this condition is not important.)

5. A birth certificate or evidence of the date of birth, e.g., a copy of driver's license if date of birth is shown on it.

6. Applicant must submit a permanent postal address to where all correspondence can be sent (consulate, travel agent, etc.).

7. All applicants for a license must give *at least two weeks notice* before license application can be processed.

8. License applications can be made to the Radio Licencing Section, Post Office, of any of the 17 main cities or to Radio Regulatory Section, Post Office Headquarters, Wellington. It is recommended that you send your application to the Radio Licencing Section, Post Office Engineers Office, at your point of entry, or to Post Office Headquarters, Wellington.

9. Visiting amateurs will be allocated a callsign from the ZL0 series.

10. There is no charge for the service.

While on the subject of reciprocal licenses, I have nothing but praise for the FCC in the States and for the Department of Communications, Vancouver, Canada, for the prompt attention to my applications for reciprocal licenses to use on my visit to USA and Canada in May through to July this year. I made the usual applications for the licenses early in January, and one month later I had received both reciprocal licenses, well before my projected departure date.

We will have three weeks on a Friendship Force holiday at Kauai, Hawaii, Spokane, Washington, and the Seattle area, and after that period we will be proceeding on an independent couple of month's holidaying in Canada and the States. I shall be looking forward to many QSOs on 2m as we travel around with the 2m handheld, and also some HF QSOs on the HF bands while visit-

ing at Port Coquitlam, near Vancouver, mid-May to mid-June, where through the courtesy of my host, Jack VE7CMD, I hope to have the use of his HF gear. Listen out for ZL/VE7 portable about that time as I will be looking forward to QSOs with those who read this column.

I shall also be visiting amateur friends in Charleston, West Virginia, Buffalo and Amsterdam, New York, Peterborough, New Hampshire, Hartford, Connecticut, and Prince Edward Island, Canada, in the later part of June and early July.

Visiting amateur radio operators with whom you have already made contact is the fulfillment of the friendship begun on the air, and something I can well and worthily recommend to those who are able to travel overseas. I have had endless hours of pleasure from such experiences; in fact, this will be my third visit to Port Coquitlam in ten years, with many pleasant QSOs in between times.

IARU CONFERENCE "SHORTS"

All but four of the delegates took advantage of the visitors' license ZL0-series offer, and those who had sent license details in advance were given their ZL licenses and a supply of preprinted QSL cards on arrival.

There was an interesting sidelight to that too: All the Indonesian delegation joined NZART. When asked why, they said, "We have a ZL call, therefore we must join your society." Wouldn't this be a marvelous attitude to apply everywhere! It would make our amateur organizations much stronger numerically than we are now—with only about half the licensed amateurs being members of their national societies.

The ZM6ARU station and the Conference Award generated a lot of interest worldwide—in all, some 2500 cards, including 120 OSCAR-10 QSOs were dispatched through the bureau.

Bob Holt ZL1BBZ, the mini-bus driver for the ladies, took a week's leave to be amongst those lovely ladies—he ran up well over 2000 km during the period of the Conference chauffeuring the ladies around on their sight-seeing trips. The success of the ladies' programme was summed up by a delegate saying he did not have to worry about his wife during the day and she was too tired to want to go out at night!

SILENT KEY

Mrs. Myrtle England ZL4GR passed away on 31 January, 1986, just six days short of completing 56 years as a licensed amateur. "Myrt," as she was known on the air, was New Zealand's first licensed woman amateur radio operator, receiving her license on 6 February, 1930. She was honored at the 1980 NZART Conference when she was awarded WARO's (Womens' Amateur Radio Operators) first 50-year Certificate and elected an Honorary Life Member of that organization. Myrt was active in local and DX operating—she operated as a relay station during the Napier earthquake in 1931, a base station during snow-storm isolation, and a valuable aid in Search and Rescue over many years.

Myrt's friendly voice on the air has been stilled now, but she will long be remembered for her distinctive personality, her vitality and enthusiasm, and above all, her wit and humor which many shared with her at Association Conferences and other amateur gatherings.

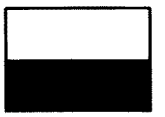
REGION III AWARD

Eligible countries are those in Region III whose amateur radio societies are members of the IARU Region III Association. These are Australia, Brunei, Bangladesh, China(PRC), Fiji, French Polynesia (FO8 only), Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Pakistan, Papua New Guinea, Philippines, Singapore, Solomon Islands, Sri Lanka, Thailand, Tonga, and Vanuatu.

Plus one country credit from U.S. Territories in the Pacific, from Guam, Northern Marianas, American Samoa, Wake Island, Baker Howland Group, as represented by ARRL; one country credit from Pitcairn Island (VR6), Chagos Arch (VQ9), represented by RSGB. (Current total of available "countries" is 24; requirements for award as *from 1 January, 1986*: Basic—7 areas; Silver endorsement—15 areas; Gold endorsement—20 areas.

These to be reviewed as considered necessary by the Custodian, Jock ZL2GX, who will recommend appropriately to the Region III Secretariat.

Applications to NZART Awards Manager, ZL2GX, 152 Lytton Road, Gisborne, New Zealand, with NZ$1.00; if airmail postage required, add another NZ$1.00 extra. IRCs are acceptable.



POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

Many Polish scouts took part in the annual scout's jamboree on amateur bands. Participation in this fixture, serving for a consolidation of friendship among nations, will be rewarded with occasional diplomas issued by International Scouts Bureau in Geneva.

On July 20th and 21st, a meeting of members and friends of hams took place in Jaroslaw. 60 girls—radio amateurs—came to the meeting. An all-Polish Club of Women Radio Amateurs was formed. Zofia SP8LNO was elected the president and Maria SP8OBF the secretary of the "Club YLSP." The secretariat of the club announced that every 21st day of months is a women's-activity day. The club station uses the callsign SP0PYL.

On the occasion of International Telecommunication Day in May, occasional radio station SP0ITU worked on the amateur bands from 10 till 19 May last year. The radio station consisted of transceiver FT-101ZD of shortwave bands, transverter 144 MHz, radio-telephone FM306 on UHF, and antennas: dipole, inverted V, vertical 14AVQ for 7, 14, 21, 28 MHz bands. During 9 days of activity, 2821 QSOs of 92 countries and 28 WAZ zones were established. Most of the contacts were gained on the 20m band.

On October 5th and 6th last year a Convention of Radio Amateurs Railwaymen was held in Moszczenica. Dozens of hams took part in the convention under the slogan: " Railwaymen hams—boosters of technological education of society." The president of PRAA, Jerzy Rutkowski SP5JR, attending the convention, suggested a modification of the name to Polish Radio Amateur's Club Railwaymen. In consequence of a ballot, the first management of PRACR was set up. The function of the president of the club went to Henryk Paszkowski SP5HP, the vice-president, Ryszard Jablonowski SP9EES, and the secretary, Miroslawa Paszkowska SP5MHP.

The residence of the club is situated at Varsovian Communication Club "Kolejarz" Hoza 63/65 Warsaw. After the approving of the working programme, Adam Koziarski SP5AY, the author of the modification, gave a lecture on an adaptation of the radio-telephone FM-302 for a SW transceiver. An occasional radio station SP5PKP/7 began its activity on the eve of the Convention.

On the occasion of 40 anniversary of the end of the Second World War, PRAA instituted a diploma "Forty years anniversary of Victory and Peace". To win the diploma a radio amateur had to establish contacts with at least one of 38 ham veterans of the Second World War. The veterans' callsigns were "broken" with V (Victory). Mainly for good reasons, only 28 radio stations of veterans were active to 9 May 1985. Nevertheless, many Polish and foreign radio amateurs won the diplomas.



SPAIN

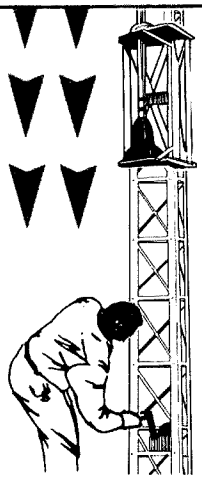
Domingo Gil Manrique EA5TX
Delegation Local de U.R.E.
Avd. La Mura 67
12540 Villarreal (Castellon)
Spain

The Spanish Radioamateurs Union (U.R.E.), through its local group in Villarreal, has established the TD-EA-CW Award, available to any ham or SWL with an official license granted by any IARU member country.

A two-way confirmed contact, direct, must be made with each of the nine EA districts over any period of time since January 1, 1976. CW only, over authorized amateur HF bands, and all must be made from the same DXCC country using the same callsign. Not valid: contacts through repeaters, satellites or similar means of communication, and mobile contacts.

Endorsement stickers: 5B (nine districts times 5 bands—45 contacts), and 160 (nine districts on the 160-meter band). Decisions of the Award Committee shall be final.

Send verified log and US$3 or the equivalent in marks, pounds, or IRCs to the Awards Committee (TD-EA-CW) at the above address for the 5-color award on heavy paper, 46 x 34 cm.■



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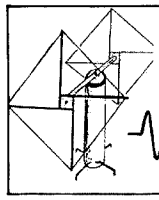
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HAM HELP

I'm looking for manuals for the following equipment: Topaz model 2LRA117SN anti-brownout ac line regulator, Motorola model XT1034C/T1034C rf signal generator, Plessey model MRA101 Tellurometer, Motorola HT-200 low-band walkie-talkie, Supercall model 6080KM mobile telephone, and the following CB radios: Claricon Raider, JIL model 615CB, RCA model CRM-P3A-5, Radio Phone Mark VII, Lloyd models A-400 and A-410, Kraco KCB-2340, Pace 8015, Pony 40, Hy-Gain 9 model 2679A, Hy-Gain 7 model 3107, President John Q, Cobra 19 and 21 XLR, Johnson 123-SJ, Midland 13-884, Spitfire Mark II, Royce 1-648, Ross CB-1000, Fanon Convoy PLLF, Prominent PT-23, Pony model CD-705S, Beltek Rough Rider model W5396, Fanon Fanfare 330 Convoy (23 channels), Fanon Courier Classic III, and Beltek W-1326F.

I also need CB Photofacts; a service manual for a Pace Base Command model P-5407 dummy load/wattmeter/swr meter; service manuals for Yaesu models FTC-2203, FTC-2205, and FTC-2640; back issues of *CB, S9, Canadian Transceiver*, and any others; NRI/McGraw Hill VCR servicing courses; and a service manual for a Hamlin MLD-1200-3.

Rejean Mathieu VE2EUI
1897 3rd Avenue
Val D'Or Quebec J9P 4N7

I am looking for a schematic and a manual for the Harvey Wells Bandmaster Senior model TBS-50C transmitter and power supply. I will pay for copying or will buy them—whichever you like.

Charles E. Phillips WB8AGB
402 Wickshire Lane
Durand MI 48429

Does W6RO aboard the Queen Mary QSL? I worked them in June, 1985, and so far, through mid-January, three cards, complete with SASEs, have gone unanswered.

Also, I'm trying to locate a source for 36-mm vernier dials to replace those on a home-brew antenna tuner I bought. The vernier shafts extend 1/2" behind the panel, and the two mounting screw holes measure 1-1/4" center to center.

Last, but not least, where can I obtain a male plug for the user port on a Commodore 64 computer? It has a protective shell and a strain relief to prevent possible shorting of the contacts. The one included with my Kantronics Packet Communicator doesn't have the shell, and I'm worried about possibly shorting something out, damaging the computer and the TNC.

Gary Payne KE6CZ
1347 E. Dakota
Fresno CA 93704

I need NAVSHIPS 91713, 93241, and 93788 Volumes 2 and 3.

C. T. Huth
229 Melmore St.
Tiffin OH 44883

I need information on converting my Kenwood TS-180S with the WARC mod for 4.5–5.0-MHz MARS operation. I have already tried the fixed-crystal position with no luck. Any suggestions?

Dave Whaley WB9SES
9 Quali Run
L.I.T.H. IL 60102

Does anyone know of a shortwave facsimile program for the Commodore 64 that receives FAX weather maps?

David Sakowich
15 Cove Street
Chelmsford MA 01824

I need manuals and schematics for a 2-meter SBE SB-144 transceiver, and for a Sears 412-3573 2-meter transceiver.

Don Norman AF8B
41991 Emerson Court
Elyria OH 44035

I would like information about programs and interfaces for putting the IBM PC on RTTY, packet, FAX, and SSTV.

Irenee Pratt F6GAL
5 Bis, Rue Thirard
94240 L Hay Les Roses
France



PROPAGATION

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20					15					
ARGENTINA									15	15	15	
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

G=Good, F=Fair, P=Poor.

JUNE

SUN	MON	TUE	WED	THU	FRI	SAT
1 G	2 G	3 G	4 G	5 G	6 G	7 G
8 G-F	9 F-P	10 P	11 P	12 P	13 P-F	14 F
15 F-P	16 P-F	17 F-G	18 F	19 F-G	20 G	21 G
22 G-F	23 F-P	24 P-F	25 F-G	26 G	27 G	28 G
29 G	30 G					

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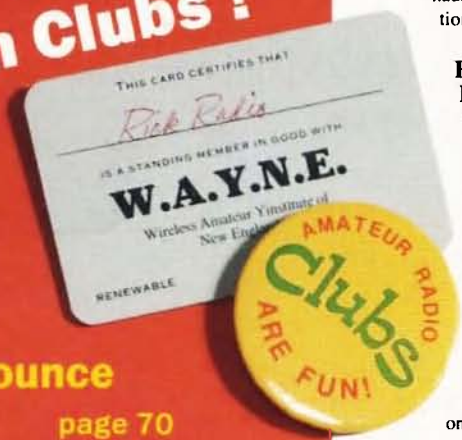
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Close-Up On Clubs !



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C-64 S-s-s-tutter Fix
This is a guaranteed, sure-fire cure for keybounce. WA4BLC 70

Departments

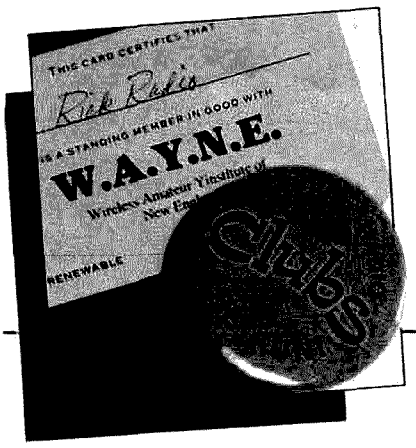
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102 Corrections
110 Dealer Directory
80 Feedback
20 New Products
88 NK6K) Packet
110 Propagation
83 QRP
7 QRX
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73 Amateur Radio®

ISSUE #310 JULY 1986

Focus On Clubs

How To Build A Great Ham Club 26

Not only is this the first article in this month's issue (not, of course, because it was written by the Boss), it sets the theme for our focus on clubs. Why are so many clubs going down the tubes? What can be done to increase the level of enthusiasm in yours? There's no sure-fire formula for success, but there are a few key concepts that must be understood before a club will really take off. Here are those concepts.

Bozo and the B-Hunt 36

No, not the clown. We can't tell you what this article is about without giving away the punch line, so let's just say that your club's repeater might be the prime ingredient in an insanely fun club activity! (For those of you who can't wait to get to page 36, here's a clue: *The music stopped, the lady died.*)

HAMS Against Drunk Driving 38

It stands for the Highway Amateur Monitoring System, a program designed to involve ham clubs in the fight against drunk driving. You certainly can't get any more public-service oriented than that. Use the ideas presented here to form a HAMS unit in your home town.

Future Hams of America 44

This is an example of what a club can do when *everybody* pitches in! The Council of Eastern Massachusetts Amateur Radio Clubs (CMARC) wouldn't settle for a ho-hum mall demonstration: They invaded the Boston Museum of Science and introduced 8,000 people to the excitement of ham radio! Here's how they did it, and how *your* club can do it, too!

Publish Or Perish 48

Look, we read about 150 club newsletters every month as part of *73*'s Newsletter of the Month contest. Believe it, if your club publishes a newsletter, you need to read this piece by N1BLH. In it you'll discover what makes a great newsletter great, where to get material, what sort of layout to use . . . in short, everything that you need to know to publish a dynamite newsletter. (Past winners of the NOTM award may skip to the next article.)

Introducing: Kit Corner

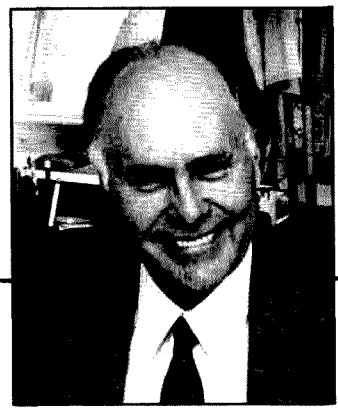
The DSE Radio Direction Finder 64

We're trying something new here, a cross between a construction article and a review. The idea is to introduce you to all of the various kits that you can build, with the hope that you will start building them. Dick Smith's RDF is a clever little gizmo which electronically rotates four whips at 1,250 rpm to determine the bearing to a transmitter; the bearing is displayed on a 32-LED compass rose.



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NEVER SAY DIE



WHY WEREN'T YOU THERE?

Just about everyone in amateur radio who's been doing anything more than rag-chewing what's left of their lives away turned out for Dayton again this year. It was mobbed, as usual.

No matter how many cavernous buildings they add to the Hara Arena, the manufacturers and ham dealers seem able to fill 'em up. One reason for the action is the whipsawing of dealers by hordes of unscrupulous hams dashing back and forth, getting ever lower ham gear prices. Dealers are faced with the choice of making a dollar or two or not making the sale. The prospect of packing up all that stuff and trucking it back to the store a couple states away eventually makes even a small loss on the sale attractive.

One result of this has been the gradual disappearance of many larger ham dealers as exhibitors.

Our hobby, as you know, is in reality a whole bunch of related hobbies. . . DXing, packet, repeaters, meteor scatter, moonbounce, service nets, QRP, certificate hunting, SSTV, RTTY, and so on. Dayton has become the mecca for these ham splinter hobbies—a place where the annointed are able to get together every year and outlie each other.

It's also heaven for the dedicated scrounger. The flea market area sells out completely—acres of surplus equipment going back at least to WWII. Come to think of it, the surplus WWI gear seems to have stopped showing up. When I was getting started in the hobby the surplus stores on Canal Street in New York still had piles of WWI radio surplus.

I wandered out into the flea market with an idea of awarding a prize for the most useless piece of junk I could find. In no time I had so many top contenders for the award I had to give it up. I did note a definite drop in Heath Twoers on display, thank heavens.

I would like to personally thank everyone who took the time to stop at the *73* booth and say hello, wishing me luck with the magazine. My apologies to the several thousand more who missed me while I was seeing the other exhibits.

One thing really worries me though. Unless we have some success in getting our hobby growing again—which depends entirely on YOU—we're looking at a rapidly shrinking hobby. This means that unless you take very good care of yourself, we're going to run out of hams. I was dismayed at the number of you I saw who are recklessly ruining your most important possession—your body. Lordy, I saw great big fat guts hanging out all over the place—beer bellies by the thousands. Many hams, knowing my feelings about smoking, put 'em out before saying hello. But I want you to know I was out there watching you. . . I saw you light up again after leaving my booth. Do you really need someone to hit you over the head to get you to make up your mind to stop smoking?

You know as well as I do that smoking is killing you, slowly but surely. It's working on you, preparing you for heart trouble, cancer, emphysema, and dozens of other exceedingly painful slow-death illnesses. My father smoked for fifty years, swearing nothing would ever make him stop. When he began passing out now and then he sure stopped—and lived on twenty years more. But the last few years were hell. His emphysema got so bad he couldn't breathe without an oxygen tank. He couldn't walk more than a few feet, even with oxygen. It's something to think about as you reflexively pull out another cigarette and light up.

Of course if you don't mind giving up about ten years of your life for the pleasure of smoking. . .

Continued on page 10



"I don't do anything much! He calls CQ and answers all questions!"

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Repeater Rules

THE FCC has taken positive action in the matter of repeater frequency coordination. In a final ruling on PR Docket 85-22, the Commission recognized the need for frequency coordination and included a definition of a frequency coordinator in Part 97. In cases of co-channel interference, the new rule stipulates that a non-coordinated repeater has the primary responsibility for resolving the problem. The rule does *not* make coordination mandatory, so repeater owners in less populous areas can continue to operate without a coordination council. Also note that owners of coordinated repeaters are not absolved of blame in interference cases . . . the rule is not intended to be used as a tool to force machines off the air. WA6ITF has the complete rundown in Looking West this month, beginning on page 87.

Canadian Setback

JACK RAVENSCROFT VE3SR has lost his case. Jack was sued by Tim and Dale Houghtby, who claimed that Jack's transmissions interfered with their electronic organ, their microwave oven, their furnace, and just about everything else electronic in the Houghtby house. The Canadian DOC examined the ham station and pronounced it clean. The judge, however, found that Ravenscroft's transmissions were a nuisance and issued an injunction forbidding Jack from transmitting from his house in any way that would interfere with electronic equipment owned by the Houghtbys. In addition, Jack was ordered to pay an award of just over $2,500 plus court costs. The decision sets a terrible precedent. WA6ITF, writing in the *Westlink Report*, says that some Canadian amateurs intend to force the government to step in and reverse the ruling by bringing a massive suit against a major Canadian broadcast company, claiming it to be a public nuisance.

Dayton Dossier

THE DAYTON HAMVENTION was incredible! This year's crowd was the largest ever, with 28,000 glassy-eyed hams tearing around deep in the throes of a spending frenzy. Most conspicuous were the dozen or so dealers selling IBM PC clones, all of them of course "99% compatible," whatever that means! Every day at Dayton held a special surprise. On Friday, some idiot tossed a stink bomb between the ICOM and the Kenwood booths in the main arena. On Saturday, an extension cord overheated and smoke filled the large ballroom; and the place was evacuated for about 30 minutes while the fire rescue team checked things out. (I'd like to congratulate the Hamvention security team on a very professional evacuation.) On Sunday, the main arena was plunged into darkness for nearly four hours when a pole pig roasted itself. Predictably, the darkness did not deter anyone from browsing, and it was nearly business as usual with the aid of flashlights (a booth in the arena was selling them for a dollar). Luckily, the lights came back on before the giant prize drawing on Sunday afternoon. Business was brisk all three days, and the weather was absolutely perfect over the entire weekend.

Lots O' Islands

BILL GOSNEY KE7C of the Whidbey Island DX Club (Bill also runs the *73* Awards Program and coordinates our SSB championships) sent in the latest list of countries for the **Island DX Award**. To qualify for the certificate, you must confirm at least 50 of the islands on the list. There are endorsements for SSB, CW, RTTY, SSTV, OSCAR, and so on. The list is pretty long; if you would like a copy, drop Bill an SASE care of the Whidbey Island DX Club, 2665 North Busby Road, Oak Harbor WA 98277.

Cliff Hanger

CLIFF WELLS KA7TVC decided to put an AEA Isopole up on his building in Kirkland, Washington. He asked the building's owner, who said it would be OK. Cliff put up the vertical so that it extended a few feet above the roof. Then a neighbor told him that the antenna was in violation of a city ordinance that regulates outside transmitting antennas, and that it would have to come down. Cliff asked about the ordinance at city hall, and was served a citation for breaking a three-year-old Kirkland law that requires a public hearing and a $350 fee whenever a transmitting antenna is put up. The best part: The law regulates *transmitting* antennas—if the Isopole were to be used only for receiving, it would be perfectly legal. Cliff has appealed the citation, and hopes that the law will be modified in light of the FCC's recent ruling on PRB-1.

Santec Save

CLIFF RODGERS of Beaumont, California, extricated himself from a tricky situation recently with the help of his trusty Santec HT. While spending the night in a motel "known for its low rates and cold pools," Cliff and his wife were disturbed by a loud pounding on the door. The view through the peephole was not promising, and Cliff decided to telephone the motel's security desk; unfortunately, the low rates included no phones. Thinking quickly (the pounding was getting louder), Cliff reached for his trusty HT and, with the help of a few local hams, got a message through to the motel's security man. The story has a happy ending, and Cliff notes, "Now when I go to faraway places with strange-sounding names, I always check to be sure my trusty HT is charged and packed!"



Firefighters rushed to the Dayton Hamvention after a smoking extension cord forced evacuation of the Wampler Ballarena.

Hambassador

ADVANCED ELECTRONIC APPLICATIONS, INC., has announced a new award designed to encourage hams who promote amateur radio to those outside of the hobby. The **Ham Ambassador Award** will be presented to the amateur who, in the opinion of the judges, has contributed most to introducing the public to amateur radio. A $1,000 prize will be presented to the winner, who will also receive round-trip airfare, meals, and hotel accommodations to the ARRL National Convention in San Diego on September 6, 1986. Any ham may nominate any other ham for the honor; the nomination must be made on a special AEA Amateur Ambassador Award nomination form, available by sending an SASE to AEA, PO Box C-2160, Lynnwood WA 98036. Nominations close August 15, 1986.

Top Ham

ROY NEAL K6DUE has been named **Ham of the Year** by the Dayton Amateur Radio Association (DARA). The award, presented at the Saturday night Hamvention Banquet, cited Roy for his outstanding contributions to the hobby, including his many promotional films ("Moving Up to Amateur Radio," "The World of Amateur Radio," and videos featuring the ham-in-space program) and his active role in convincing NASA that sending a ham transceiver into orbit with the space shuttle was "OK." Poor Roy had to give two speeches that night, as he was also the keynote speaker at the banquet. Saturday evening saw the presentation of two other honors: the **Special Achievement Award** to **Fr. Michael Mullen WA2GQW**, and the **Technical Achievement Award** to **Doug DeMaw W1FB**. Fr. Mullen is president of the International Mission Radio Association, an organization that equips hams involved in missionary work with amateur radio equipment. Doug DeMaw is world-famous for his easy-to-understand technical articles in *QST*, and served as the magazine's Senior Technical Editor until his retirement in 1983.

SARC Certificate

A SPECIAL AWARD IS AVAILABLE from the **Scarborough (Canada) Amateur Radio Club** to commemorate its 40th anniversary. To qualify, you must accumulate points by contacting VE hams: 20 points from VE3 and 20 points from other parts of Canada. For Canadians, every QSO counts one point. Contacts with stations using a special-event prefix or with members of SARC are worth five points. Ten points are awarded for a QSO with SARC club station VE3WE. For U.S. and DX operators, all of the points and bonuses are doubled. To claim your award, send a copy of your log, signed by two other amateurs, and one dollar or three IRCs to SARC, Box 174, Station D, Scarborough, Ontario, Canada M1R 5B5.



Bud Hill K1PD, Elmer to over 800 code students, receives a plaque of appreciation from Chelmsford ARC President Jim Fisk.

Extra Pool

THE NEW POOL of questions for the Extra-class examination has been released by the FCC. The pool of 456 questions must be used by volunteer examiners starting October 1, 1986, although VECs can start using them at any time. New questions have been added which deal with the volunteer examination program, including reimbursement, preparation of tests, and VE accreditation. Other questions have been modified slightly for clarification.

Packet Mania

NEXT MONTH is special! If you are interested in packet radio, don't miss the August issue of *73*...an entire issue devoted to packet! You'll find out how to set up your own station, discover the nuts and bolts of networking, and explore the esoteric side of the medium with the top names in the field. You won't want to miss this one—better check your expiration date!

SWL Pubs

TWO NEW PUBLICATIONS of interest to shortwave listeners are available from West Germany. The first, Dr. Jurgen Trochimczyk's Radio Beacon Handbook, lists more than 8.500 long- and medium-wave beacons from around the world. Stations are organized by callsign. The second book, Bern Friedwald's International Listening Guide, presents shortwave broadcasts in English, arranged by transmission time, and details their target areas and frequencies. Also included is a list of broadcasters' addresses. For information about the *Beacon Handbook*, contact Wilhelm Herbst Verlag, Postfach 45-05-06, D-5000 Koln 41, West Germany; if you're interested in the *International Listening Guide*, get in touch with DX Listeners' Service, Merianstr. 2, D-3588 Homberg, West Germany.

Code King

BUD HILL K1PD was honored recently by the Chelmsford (Mass.) Amateur Radio Club for 20 years of teaching Morse code. Bud has taught nearly 800 people the code, including 100 participants in the club's Police Amateur Radio Team (PART), an organization which meshes ham radio with law enforcement. When Bud first tried to learn Morse, his studies were impeded: "I couldn't practice code when my daughter's dog was in the house—he barked all the time." When asked how he solved the problem, Bud smiled and said, "They don't live here anymore."

New News

WHAT'S NEW THIS MONTH in *73*? A new feature, **Ham Awards, by Bill Smith N6MQS**, appears on page 107. Bill has been busy designing worksheets for the major on-the-air awards; every month we'll print a worksheet and a set of rules back-to-back so that you can cut the page out of the magazine and put it into a folder. On page 80 you'll find an order form for the all-new 73 **QSL Cards!** We've had so many requests for our high-quality, low-price QSLs that we've brought them back.

important!

AS REPORTED LAST MONTH in QRX, the FCC has proposed enhancement of the Novice-class license to include data and voice operation on three bands. The NPRM, PR Docket 86-161, calls for data privileges from 28.1 to 28.3 MHz, SSB from 28.3 to 28.5 MHz, all amateur privileges from 220 to 225 MHz, and simplex and repeater privileges from 1246 to 1260 MHz. There are power restrictions on each band: 200 Watts PEP on 10 meters, 25 Watts on 1-1/4 meters, and 5 Watts on 23 centimeters. The new rule would allow higher-class stations to run their legal limit in these Novice subbands. Novices would be allowed to operate through a repeater, but would not be allowed to be the trustee of one. Initial comments are due at the FCC by July 16th, and reply comments must be received in Washington by August 20th. To file comments, send an original and five copies (11 copies if you want each Commissioner to have one) to the FCC, 1919 M Street NW, Washington DC 20554. Include the docket number in the head of your comments (see page 89 for an example page). The Commission is especially interested in hearing what you think about reducing the term of the Novice license to encourage upgrading, and whether the General-class exam should be broken into two parts, one covering VHF and one covering HF, to help Novices upgrade to Technician.

QRV

THIS EDITION of QRX comes to you with the aid of *The W5YI Report*, *Westlink*, *Sweden Calling DXers*, *Splatter*, and Claire Azzalina. Send your photos and stories to *73* Magazine, WGE Center, Peterborough NH 03458.

NEVER SAY DIE

from page 4

and are ready to face lung cancer, heart attacks, and emphysema, well you'd better get busy getting more hams so we'll have someone to replace you—and soon. I can see the 2020 Hamvention with one ham creeping slowly into a hotel room in the Dayton Biltmore, moving his walker up to the card table exhibit of Japanese gear being sold by the sole remaining ham dealer . . . and asking for a discount.

A ham friend of mine has some houses he rents out to students at a nearby college. He keeps an eye on 'em and has been apalled to see that a high percentage of them are alcoholics. Many of them put away one or two six packs of beer a night. There's nothing like peer pressure to overcome common sense. I don't know how I managed to avoid getting messed up when I was in college. My fraternity brothers made a big deal out of drinking beer. Oh, I tried it, but it tasted awful, so I never learned to like it. I tried smoking, too—didn't like that either. I guess peer pressure didn't work well with me. I was never much of a follower—preferring, from an early age, to be a leader.

Look here, I know how difficult it is to diet. I'm a known fooder. I've been dieting since I got fat when I was about seven years old. I did thin down a bit while I was in the Navy—had to in order to look good in my tailor-made uniforms. In 1972 I got tired of being fat and went on a long, slow diet, taking off 85 pounds. And, unlike most dieters, I've managed to keep most of it off ever since.

I know all about fasting and dieting. My body is ready to fight back at the slightest sign of a food cutback. If I skip lunch, by two in the afternoon my body is in a panic—Oh God, he's fasting! It quickly gives me a big headache, makes me sweat, get dizzy, and feel as if I haven't eaten for a week.

Dieting isn't difficult, once I make up my mind to it. My body doesn't fight dieting like it fights fasting. I can lose a third of a pound day after day for months with no serious physical effects. Of course it does take a lot of resolve to pass up ice cream, desserts, and such nonsense.

A serious dieter has an accurate doctor's scale and weighs in meticulously every morning, ticking off the third-pound losses. A serious dieter wants that scale to go down so badly he brushes his teeth before weighing in to get rid of that heavy plaque, shaves to cut off that heavy stubble—and maybe spits a couple times for good measure. It's a good idea to check for ear wax, too.

Next year at Dayton I want to see a bunch of younger-looking old-timers, without those gross, disgusting beer bellies and hacking coughs, going by my *73* booth. We used to believe that youngsters were the future of amateur radio; now we know the odds are good that the future is us old-timers.

Look here, if anyone as weak-willed as I can diet and take off 85 pounds at one whack . . . and keep it off for 14 years . . . there's no good reason why you can't do it too. The next thing you know you'll be trimming down and joining me out there putting in a couple miles of brisk walking every morning. No, I'm not pushing for you to become a fitness fanatic—I just want you to be around to renew your subscription to *73* for a few more years and say hello to me at Dayton, Miami, Orlando, Dallas, Atlanta and so on.

A recent large-scale study on alcohol showed that even light drinkers substantially worsen their odds for living long lives. As I recall the radio CBS report, one drink a day cuts your chances of living to 72 in half. A couple drinks a day cuts it to one third. Now, how about a nice cold 807?

Thank heavens the studies show that sex contributes to longer life! It's a darned good substitute for liquor and cigarettes . . . unless your wife catches you.

Ham Industry Meeting

About a hundred ham industry people gathered at Dayton the evening before the Hamvention. Maybe 40 firms were represented—a pretty poor showing. The main concern for those concerned enough to come to the meeting was the increasing drop in new hams—down 8.5% over the previous year, with no turnaround in sight.

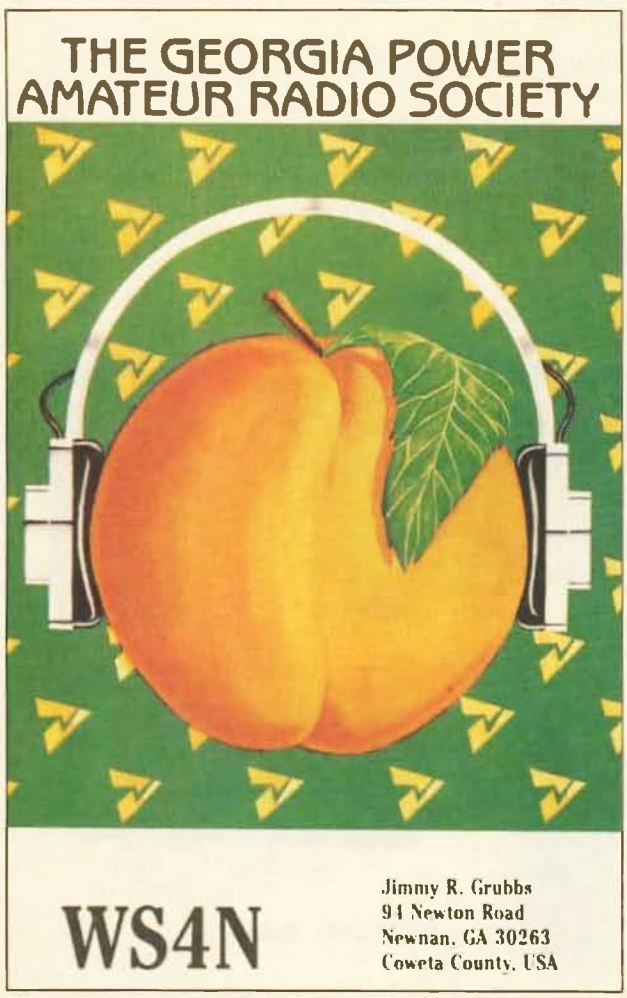
A year ago at Miami some industry people met and came up with an idea for a ham comic book as a way to interest youngsters in the hobby. That was while I was divorced from *73*, so I missed the meeting. This project is moving along slowly.

I explained the approach I feel is needed if we're going to get amateur radio really growing again. This means getting youngsters coming in again. In order to do that we need to rebuild the school radio club infrastructure which brought us hams until the clubs folded around twenty years ago—victims of the Incentive Licensing disaster.

I explained that we need to get what we have left in ham clubs to sponsor school radio clubs in their areas—Elmering them. No, it won't be easy. Schools will fight any changes, as they always have. They'll put up all sorts of obstacles to anything which means more work for them, even slightly more work. But if we work together, sharing our successes, we can do it.

Without a rebuilt radio club infrastructure, I don't believe comic books or TV shows about amateur radio will get us much. Look at how successful peer pressure is in getting kids to go for cigarettes, beer, pot, and coke! It used to be as effective selling amateur radio—with benefits to everyone. Most kids got started on lifetime high-tech careers—our country had the engineers, technicians, and scientists which put us number one in the world in technology.

It's up to us whether we'll be bringing over more and more Japanese technicians to repair our radios. Remember, we're



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

heading into a communications age beyond anything you've imagined. We're going to see communications expand by a factor of a thousand to a million over the next few years. This is going to require millions of engineers and technicians—are they going to be American or Japanese? The answer is up to you and your ham club.

The industry people listened politely and most agreed with my proposal. But of course the old code-free license matter came up. Maybe, if we can get a code-free license, we can get youngsters into amateur radio. Maybe, but without the school radio clubs, I doubt it.

Only one person held out for maintaining the Morse-code test, with the others all in favor of some sort of no-code test. The holdout's credibility was somewhat weakened when it was noted that his firm's main business is selling code courses. It seemed like a triumph of self-interest over reason.

The next obvious question was, well, if just about every industry person wants a no-code license, how can we get one? The FCC's Johnny Johnston was there, so they asked him what might do it. Johnny made it clear—the FCC went to a lot of time and expense to try to get a no-code license. The ARRL killed it, put it in its coffin, and drove a stake through its heart. The only way you're going to get the Commission to reconsider no-code is by getting the ARRL to pull the stake back out of its heart.

Hmmm. How can we do that, they asked? Lew McCoy, who spent much of his life working at ARRL HQ before he retired a few years ago, got up and explained the facts of life. If you want the ARRL to favor no-code, it's very simple. You have three other ham magazines for your advertising—*CQ*, *73*, and *HR*. If you move your ads from *QST* to the other magazines you'll have the ARRL Board down picketing the FCC for a no-code license.

Everyone agreed Lew was right. It was too self-serving for anyone from the three magazines to do more than join the cheers. No one from the ARRL bothered to come to the ham industry meeting, so there was no comment from them.

I will frankly be surprised if any advertisers have the guts to try and put pressure on the ARRL. I watched every major manufacturer go bankrupt or change to some other business twenty years ago, advertising first in *QST* right to the bitter end. You can look back in your old copies of *QST* at the ads by Hallicrafters, Hammarlund, Johnson, Barker & Williamson, Webster, Sideband Engineers, Gonset, Central Electronics, Harvey Wells, Multi-Elmac, World Radio, Lakeshore Industries, Eldico, Sonar, RME, Millen, National Radio, Thordarson, United Transformer, and so on.

It'll be interesting to see what happens. My bet is that nothing will. Safe bet, at least for quite a while. Until we have school radio clubs in place to help youngsters get licensed, it seems irrelevant to me. Once we have 'em, you'll see me pushing to replace the outmoded code exam with a tougher technical exam—getting away from forcing kids to learn an unneeded skill in this packet world and into really getting started toward technical understanding, which will stand them in good stead the rest of their lives.

It would be nice if the ham industry people became more involved with the health of their industry. They certainly have everything to gain from a fast-growing hobby as compared to the dying one we have now.

Will I be seeing you at Dayton next year? Will I be seeing a new, thinner you? A you which doesn't stink of cigarette smoke? It's the big show of the year, so see what you can do.

A NICE THICK MAGAZINE

One thing that gets mentioned frequently is how much you prefer a nice thick magazine to a little bitty skinny one. Me too, even though it's a lot more work. With some cooperation from you, we'll have *73* so thick you won't be finished with it by the time the next issue arrives—you know, like it was a few years ago.

The formula for a thick magazine is simple—the more ads we have, the more pages of articles we can run. While I don't have to make any money with *73*, I also am not dumb enough to plan to lose a lot of money with it. How do we get more advertising? That's simple too—one way is by getting more readers so ads in *73* will sell more products. Another is to let advertisers know when their ad in *73* got the sale for them.

I'll appreciate any help you can give on getting subscribers. Maybe you can do something with your club—I've got some special bonuses for clubs. Perhaps your club is going to have a hamfest or auction and could run a *73* table. Or maybe you have an idea I haven't thought of yet. You know, less than half the hams read *any* ham magazine. Maybe you can find out why they don't—or even better, how I can get them to break this disgusting habit. Check around and let me know. . .okay?

If advertisers think one of the other ham magazines is going to sell more gear for them, they'll spend their ad dollars there and I'll have fewer pages for you. If you're into heavy-duty construction projects, patronize *HR* advertisers. If you're into contests, hit on the *CQ* advertisers. If you want a bigger, fatter *73*—and no, I won't write more pages of editorials than I'm doing now, so don't gripe about that—with more simple construction projects, more reports on OSCAR, packet, and other fun activities—run your fingers, do not walk them, to the Reader Service card. Next, pick out the advertisements which almost have you ready to write a check or make an 800 call to order—mark the card and get it to me.

Buying new gear is one of the most exciting parts of hamming. It's exciting to open the box, get the gear set up, and make that first contact! Two demerits if you have to use the instruction book. Tsk. I'd as soon consult an instruction book as ask directions when I'm lost. No way!

Unless you're really into reincarnation, you've got to plan to only live once. You aren't going to waste a whole lifetime sitting there braying on 75m are you? Or waiting forever for someone to discover your repeater by accident? Or do you have two repeaters? With 9,759 active two-meter ops and 10,627 repeaters, a few of you have more than one repeater. Amateur radio is a whole bunch of fascinating hobbies, so why get hung up on just one? Have you tried slow scan? 2m Aurora? 80m DXing? 10 GHz? RTTY? I have and I loved every minute of it!

One of the great pleasures of publishing *73* is my responsibility to test out new ham gear. Boy, is that a tough job! Heh, heh. I just love prying the damned staples out of the boxes, then trying to shake the unit and its foam insert out of the box. There are all those plastic bags with cellophane tape which tears the bags when you try to open 'em. Each cable, connector, fuse, and other accessory is always bagged and taped. But when I get it all set up and turn it on—ahhh, nirvana.

It doesn't matter if it's a two-meter mobile rig, a 220 HT, a new slow-scan monitor, or a new keyer—it's exciting and I can hardly wait to see how it works and tell anyone all about it who blunders onto my frequency.

If you see an ad in another magazine which you just can't pass up, the least you can do is drive the manufacturer or dealer crazy by telling 'em you saw their ad in *73*. Chuckle.

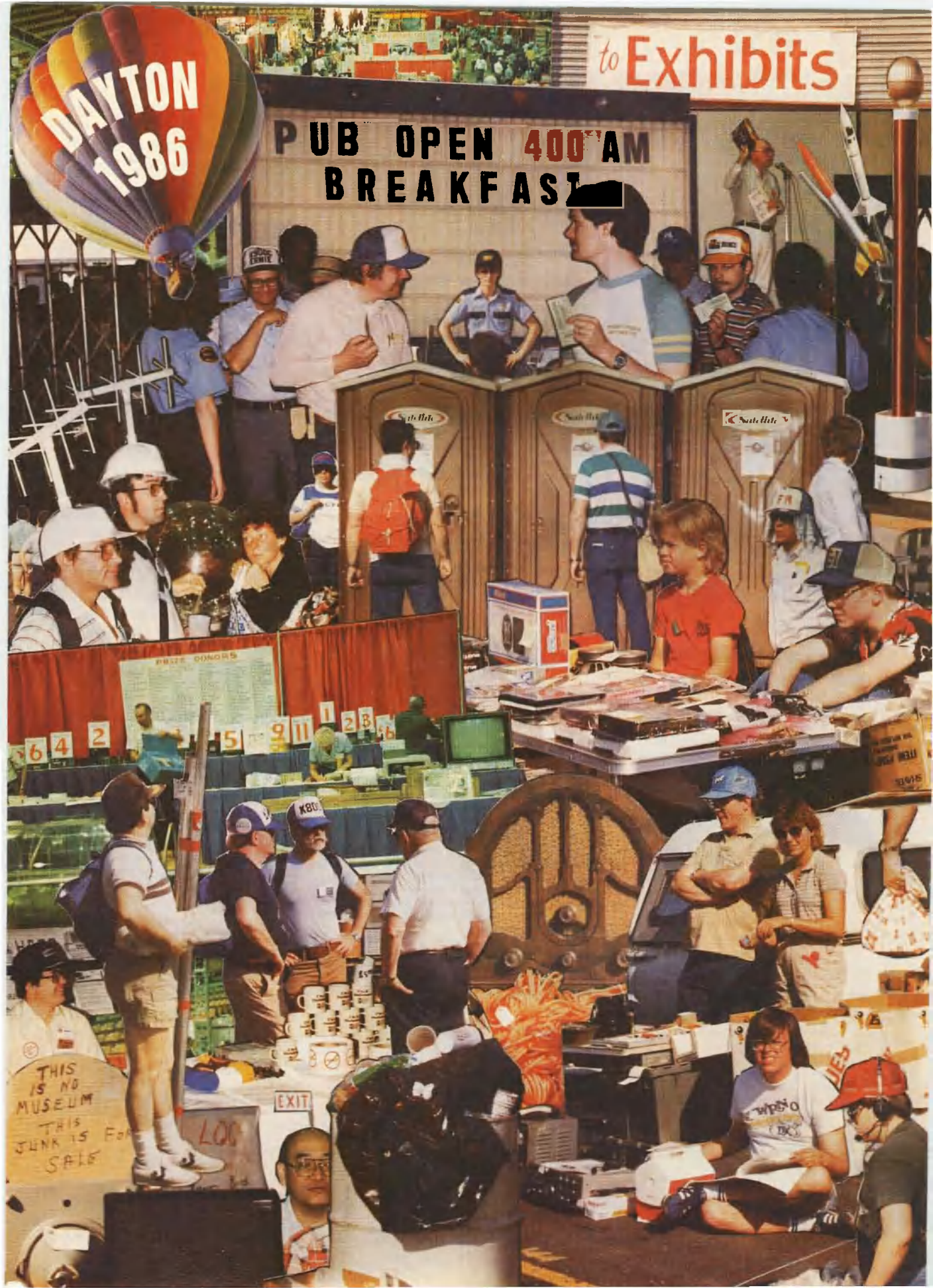
You know, if we can get school radio clubs back in business, I think we'll start seeing new young hams by the zillions—and we both know they're going to be reading *73*, where the action is. Can *73* ever get to be the size of *Byte* and *80-Micro*? Sure it can! And hamming will be one of the best known hobbies in the country—a hobby you can really be proud of. You know, both *Byte* and *80-Micro* got up to 600 pages a month—how'd you like to face that? They used to give postmen hernias.

I had a postcard the other day from a very confused reader who somehow had managed to convince himself that I took on *73* in order to make money. Great fantasy. As far as I recall, I never made much, if any, money with *73*. How do you run a business losing money every year? Mostly by being smart enough not to lose enough so you go out of business. It's called the Ponzi Scheme after a chap in the 20s who made millions with the idea.

When CW took over *73* they looked at it and decided running a magazine for fun was crazy, so they set it up to make money and damned near killed it. No one makes money with ham magazines except the ARRL. Computer magazines make millions. Audio magazines make millions. Ham magazines, at best, break even. That's my experience. Of course if we manage to develop 1% of the population into hams—about 2.5 million—and the *73* readership goes up to maybe 500,000—then I might not be able to prevent myself from making money. No, I'm selling myself short. . .I'd manage. Let's get those 2.5 million hams and I'll prove it.

In the meanwhile please get your Reader Service card to me—and none of that marking every number, either. If I think you're fudging it just to try and cozy up to

Continued on page 74


DAYTON
1986
to Exhibits
PUB OPEN 400 AM
BREAKFAST
PRIZE DINGERS
EXIT
THIS IS NO MUSEUM THIS JUNK IS FOR SALE

LETTERS

COLD CLUB

My wife, bless her heart, let me talk her into getting involved in my hobby. Since I don't have the patience to teach a family member anything, I figured a radio club would be a good introduction.

We chose the club at her place of work. I won't name names, but it is a very large electronics firm here and they have one of the oldest clubs in the state. When the meeting started, they had the usual reading of the minutes and such. Then the subject came up that the club needed an item for its repeater. The fellas that wanted the club to buy it were asked to give the reasons. After a short discussion with a lot of "humms" and "ahs," they admitted that they guessed they didn't need the item after all, especially since they didn't intend on putting the device in anyway. They figured someone else could do that. No one had the time to work with it, so they didn't buy it.

Then it was time to nominate a new president. Everyone looked at each other, waiting for someone else to talk. Either no one cared, or they felt they might have to be president if they opened their mouth. They never did nominate anyone that night. How sad!

Another year and these guys will be gone. In the hour and a half not a word was said to us, as if we were not there or not welcome. Not real inviting. They did, however, have a very nice talk about propagation. I learned a lot from that, but my wife was pretty bored.

There is another club in town that we're going to try. It is much more active, I'm told. I sure hope so! One club isn't a good sample, but from what I've been reading, this one was a good example. Truly sad.

Dave Kelley WA7GPF
Chandler AZ

HAM AM

I have to admit that I was angered by the statement in Perry Donham's April QRX column that "the whine of heterodynes" will be returning to our voice bands. My reaction was not because I favor the abolition of full-carrier DSB AM, but because the statement went on to become a gross distortion of the arguments raised by Don Chester K4KYV and other AMers who are protesting the 50% power reduction to be forced on them when FCC Docket 82-624 takes full effect in 1990. The segment seemed phrased to do little more than to try to inflame our SSB brethren and to try to dismiss AMers as a few reactionary old stick-in-the-muds.

Far from being dead, AM is returning with a vengeance, with scores of new stations coming on each year in different areas of the country. It's ironic that AM, the pioneer voice mode, is once again a "growth mode." This seems to point out to me that something fundamental is missing from today's amateur radio. The AM resurgence had been confined to the Northeast, but is now picking up in the South and the West and in other regions. Credit for this in many ways goes to the Society for the Promotion of Amplitude Modulation (SPAM) and to the *AM Press/Exchange* magazine.

There are many reasons for this return to AM activity. Number one is because the design of a DSB AM rig is very basic. It's the simplest voice rig to design and build. You can throw one together in a weekend if you cheat a little bit and use a stereo or PA amp for a modulator. Reason number two is that the equipment and parts are available for a song at hamfests. They are usually hidden underneath the tables and scorned by most hams as junk. Reason number three is that it is just plain old fun. The element of fun is what will attract newcomers to our hobby and sustain it into the future.

Right now I can see all the hi-tech computer and packet types chuckling among themselves. So what if most AM technology is not state-of-the-art; it can be and in commercial AM transmitters it is! AM is easy to understand, it is easy to fix, it teaches people something about radio theory, and it is fun. The emphasis of amateur radio does not always have to be on hi-tech. The use of AM should be seen as a logical step in educating oneself about electronics and achieving mastery over analog electronics. From there you can move onto digital electronics. I feel it is important to know from whence you came.

The continued use of AM is in no way a threat to our bands, or to anyone else trying to pursue his end of the hobby, be it SSB, RTTY, or whatever. This is because we do live in an age of hi-tech, and AM will remain a minority mode in use by only a few hundred or a few thousand newcomers or experimenters.

Use of high-power class-C plate-modulated amplifiers on AM has taught me more about radio than anything I could have picked up using a TS-820. Contrary to Perry's claim that there are very few class-C plate-modulated rf amplifiers in use, there are thousands in use the world over in communications and broadcasting. I have been able to take the knowledge I gained in amateur radio and apply it to my job. Those thousands of rigs will still be out there into the next century, and somebody is going to have to fix them.

I recently saw a small crowd of hams at a hamfest gathered around a table where there was a small object that no one could identify or explain. It was a vacuum capacitor! One fellow asked me how many Watts he could expect to get out of "that tube." I'll bet he got his radio education putting together Heathkits and now sends his ICOM back to the factory when it breaks. All I would like to see is an end to the blatant discrimination against AM, AM users, and AM groups by the FCC, the ARRL, the mass-circulation ham magazines, and by the SSB jammers. I'm not talking about bringing back spark; I just would like to see AM come out of the closet and have hams recognize that AM is still a part of modern communications.

I am continually fascinated by the progression of technology, the rise of solid-state, LSI, computers, packet, etc. However, I feel that AM still has a place in amateur radio for the beginner, the experimenter, or the hi-fi enthusiast. AM can be state-of-the-art, too. How about an all-solid-state hi-fi AM rig? There is now a 50-kW commercial AM rig available. I personally want to experiment with pulse-duration modulation. What about AM stereo or multichannel techniques, or synchronous detection for hi-fi reception? The potential for experimentation on AM has been too long ignored by the ARRL, the ham magazines, and the general ham population that has been brainwashed into thinking that AM is dead. The potential is still there; it just cries out for use.

It is because of this continuing value of AM to the hobby that I protest the PEP power determination method that replaced the old 1-kW-dc-input rule. What is so difficult about multiplying two final amplifier parameters that caused the FCC to decide that we will all have to buy PEP power meters by 1990? Have amateurs forgotten how to do multiplication? Also, PEP has always dealt with phone transmissions. Will someone please tell me how you read the peak ENVELOPE power of a CW or FM transmission where there is no modulation envelope! The thrust of Docket 82-624 seems to be that amateur radio will eventually be turned into a CB-type service where the operators have little knowledge of the inner workings of their equipment.

No other group seems to have been singled out for so much legislative abuse. What other group will be forced to cut its power by 50%? Several times the FCC has come close to "deregulating" my favorite part of the hobby out of existence with dockets such as the power reduction or the ill-fated Docket 20777 of the mid-1970s that would have banned AM below 30 MHz by regulating bandwidth instead of restricting modes. It is this repeated legislative abuse that comes every few years that has the low-band AMers up in arms and speaking out. I for one am sick of having to fight to justify AM's existence every two or three years when some bureaucrat at the FCC or a "professional ham" at the ARRL cranks out yet another make-work deregulatory proposal to limit bandwidth to 3 kHz, cut AM power by 50%, ban AM below 30 MHz, or otherwise shut down full-carrier AM phone on the low bands so that a few more SSB appliance operators can be squeezed in to chase DX or participate in some inane contest.

AMers, myself included, are speaking out at last because we have realized that we can expect no help from the ARRL or the major ham magazines. I have not seen any mention in *QST* or *73* about the appeal of the FCC Docket 82-624 power reduction that has been filed by Glen Baxter K1MAN with the U.S. Supreme Court. It would be the first time in years that the Supreme Court has heard an FCC case involving amateur radio. AMers will continue to

speak out because rumors have been circulating about various 75-meter SSB groups trying to petition the FCC to eliminate AM from the band or to restrict it to certain frequencies. Another threat to AM is the recent ARRL board discussion about sending a proposal to the FCC to establish a 160-meter band plan that would make the frequencies below 1840 kHz CW only.

AM is a mode that is relevant to today's world, and will continue to be for some time to come. It is well suited to attracting new or younger hams with limited funds or little electronic expertise into amateur radio. I say let the AMers pursue their interests unmolested and let the packeteers, SSBers, RTTYers, and CW people pursue theirs. There is room for all with cooperation. It is the diversity of operating modes and frequencies and our ability to experiment with them that distinguishes us from CB. If you destroy that, you have destroyed the hobby.

James D. Seaman WA2AJM
Guilderland Center NY

OK, you've convinced me that AM has a place in amateur radio. I will still grind my teeth every time I hear a heterodyne, though.—KW1O.

DECENT EXPOSURE

My first exposure to radio and electronics came in the late 50s when my father gave me an AM crystal set which I attached to the bedpost of my bunk bed. I spent many hours "DXing" the Midwest listening to the farm reports.

Later I saw a Hallicrafters shortwave receiver at the local appliance store. It had an AM band and three shortwave bands with little dots marking the places I should listen for foreign cities like London, Moscow, and Amsterdam. It wasn't even hooked up for demonstration, but I convinced my dad to buy it anyway. I soon found out that the little dots marked on the receiver had no correlation to the countries listed, but I did find a surprising number of stations grouped into various areas of the spectrum from 1.6 to 30 "megacycles."

I found other areas of the bands where strange men talked about Viking Rangers, Hammarlund receivers, and dipole antennas. I also heard them talk about something called "single slop-bucket," how it would ruin the bands, and how they would never change from amplitude modulation. I heard a few men using what I supposed to be "single slop-buckets" but I had trouble tuning them with my bfo. They tended to sound like Donald Duck.

This was my first exposure to amateur radio.

Later on, during my high-school days, I learned that some of the older boys had formed a "ham radio club" and were interested in teaching other boys and girls about this strange hobby. I attended several of the meetings of the club after school and found that they were teaching something called "Morse code." I had heard this strange code on my shortwave radio, but really had no interest in learning it. I wanted to talk to the men about dipole antennas and "single slop-buckets."

The boys who taught Morse told me if I wanted to talk to the men I had heard, I would have to learn the code first. I thought this was strange, but I gave it a try. Well, unfortunately, I wasn't very good at learning the code, and the boys teaching it seemed to want to pace the class for the better students. I tried for about four weeks, but finally got frustrated and gave up.

I still wanted to know about things like amplitude modulation, dipole antennas, and "single slop-bucket." I continued to listen to my shortwave radio. Soon, most of the men on the amateur bands started using "single slop-bucket," and I stopped listening to them because they all sounded like Donald Duck, and I couldn't tune them in well enough to enjoy it. Besides, I could always listen to the BBC, Switzerland, and HCJB in Quito, Ecuador.

Well, that was 20 years ago, and since that time I have gone on to a career in electronics, first as a technician, then as a supervisor, and now as a manager of quality assurance for a company in the telecommnications industry. But you know what, until I met Gordon West WB6NOA and Loraine McCarthy N6CIO, I still hadn't been able to master the Morse code.

That little detail held me back for 20 years!

But not any more. Thanks to Gordon and Loraine, the "Queen of Code," I am now N6NKN, an FCC licensed Technician-class operator (my license was in the mail when I got home yesterday).

I cannot say enough about these fine folks. Their patience, understanding, and ability to make learning code and theory fun has contributed to the hobby immeasurably.

Most of their students continue to pursue the hobby for their Technician- and General-class licenses. I'm currently trying to push back the wall I seem to have hit at 10 wpm, but soon I'm sure I'll be able to get on 40-meter phone, or CW, and talk about dipole antennas and something called packet radio.

Some of the men I hear say packet radio will ruin the bands, and that they will never give up RTTY, AMTOR, and single sideband. I guess I really haven't missed that much in 20 years, have I?

Richard J. Zolla N6NKN
Irvine CA

SOVIET SWAP

I have been very lucky! My little boy became a General at the age of 9 and my daughter became an Extra when she just turned 12. I taught them both, and then they taught each other. My son is getting ready to beat his sister's record.

Folks have asked me to write a book to help children become hams. I suspect it will really be for adults! The secret to get the kids to learn and pass amateur exams is to teach it with a story. Kids love stories to learn from and so do adults, especially if the characters remind them of themselves. Maybe that is what is needed in *73*—a monthly section devoted to kids with a good story to help them walk through magic radio land.

I am establishing a project, "Amateur Radio Children For Peace," between the USA and USSR. I am in the process of contacting some amateurs in the Soviet Union. The purpose would be to facilitate cultural relations and awareness between licensed amateur-radio operators in the early adolescent ages between both countries by scheduled on-the-air contacts. Simultaneously, on a yearly basis there would be an exchange of participants for two weeks living among the amateur-radio community in each country. The aim is to appeal to the children of both countries, with hope that friendships will be established and fostered. Since amateur radio knows no boundaries, neither should there be limitations on the communication of love and peace.

I think this may be a rather interesting project since amateur-radio operators of both our countries talk to each other every day anyway. Encouragement of such participation, especially with the children, has its obvious advantages.

I would appreciate any recommendations and support you may have to offer. I am in the process of contacting the Moscow Radio Club and the American Radio Relay League for assistance. In the meantime, I am trying the experience with my two children. You should have seen the expressions on my kids talking to RW3DP this past weekend!

Richard Niemtzow N5EV, M.D., Ph.D.
Andrews AFB MD

GOOD START

Your April editorial stirred me to sit down and comment on the TNS/Stoner proposal and give some ideas regarding the lack of growth in ham radio.

I'm not sure that I agree with all the details of the Stoner proposal, but I do agree that a code-free class of license is a must (contrary to the ARRL) to get our hobby growing by leaps and bounds. A digital class of license is a good start. I would also suggest that additional privileges could be granted according to the ability to build (even from a kit) equipment to be used on the air.

As a self-employed person engaged in parts sales and service of CB/ham/hobby electronics, I find many old-time hams are simply knob twirlers who have to pay someone to wire mikes and solder coax connectors while they sit back and complain that no one should be a ham until he learns Morse code! Vast numbers more buy parts but don't know what to do with them, go home and blow up the parts by wrong connections, and then get on the air and tell everyone that I sell bad parts—and not to patronize my business. That, after I spent time drawing out on scratch paper simple circuits for them with no charge for my time!

Ken Losey KA8RUA
Kalamazoo MI

NEW PRODUCTS

ROBOTICS WORKSHOPS

A new series of robotics workshops is now available from Multibotics, Inc. The workshops are built around the B-100 interface module, which allows a host computer to perform as a motor controller, a voltmeter, a storage oscilloscope, an infrared controller, and an audio digitizer. Projects include demonstrations in motors and gears, generators, feedback, digital electronics, moving vehicles, and electronic speech.

The workshops range from $59.95 to $199.95, and are available for the Apple IIe, Atari, Commodore 64 and 128, Amiga, and IBM compatibles. For detailed information, contact *Multibotics, Inc., 2561 South 1560 West #A, Woods Cross UT 84087.* Reader Service number 152.

ORION ANTENNA ROTATORS

Orion Hi-Tech has announced the introduction of the RC5A-series of heavy-duty antenna rotators. The rotators are designed for large arrays, and employ high-tension-steel gear mechanisms. The rotors include a mast guide that makes centering easy.

For complete information, contact *Orion Hi-Tech, PO Box 8771, Calabasas CA 91302.* Reader Service number 167.

LYNX CABLE-TIE TOOL

A compact, lightweight tool designed to speed up on-site installation of cable ties has been added to the Lynx product line. The QC-100 tensions, ties, and trims the tail off of cable ties with a simple twist of the user's wrist.

For more information, contact *Lynx, Inc., PO Box 67, Leominster MA 01453; (800)-222-LYNX.* Reader Service number 156.

A.P.E. PCB REPAIR KIT

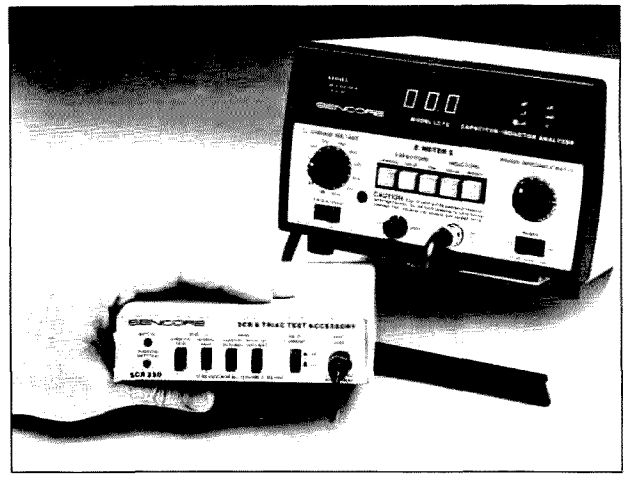
The model SRS-050 Track Repair Kit from Automated Production Equipment contains all of the material needed to repair printed circuit boards. Repairs are made with a variety of copper-foil etchings that match the existing traces. Plated-through holes are repaired by swaging an eyelet into the board.

The kit is available in four models: standard, service technician's, basic, and deluxe. The kits differ in the tools supplied, and range in price from $18 to $129. For more information, contact *Automated Production Equipment Corp., 42 Peconic Ave., Medford NY 11763; (516)-654-1197.* Reader Service number 159.

SENCORE Z-METER

Sencore has introduced an improved version of its popular Z-Meter, the model LC-75 Z-Meter 2. The new instrument checks capacitor value, leakage, and dielectric absorption in half the time required by the earlier unit.

The Z-Meter 2 checks capacitors from 1 picofarad to 200,000 microfarads to 1% accuracy, with full autoranging. The distance to a break in a transmission line may be determined by dividing the transmission line's rated capacity per foot into the capacitance indicated by the Z-Meter 2. The meter also can check triacs and SCRs with the addition of the optional SCR-250 triac/SCR accessory.



The Sencore Z-Meter 2.

The LC-75 Z-Meter 2 is $995, and the optional SCR-250 is $148. For more information, contact *Sencore, Inc., Sioux Falls SD 57107; (605)-339-0100.* Reader Service number 154.

LARSEN 2M PORTABLE WHIP

Larsen Electronics has introduced the model KD14-2M-HW Kulduckie™ 2-meter portable whip. The antenna is cut for 144–148 MHz, and collapses from its extended length of 41 inches to an easy-to-carry 7-3/4 inches. The KD14-2M-HW employs a resonant half-wave design, with a rigid impedance transformer at its base. It connects to a standard BNC jack.

For more information, please contact *Larsen Electronics, PO Box 1799, Vancouver WA 98668; (206)-573-2722.* Reader Service number 151.

ALUMA TOWERS

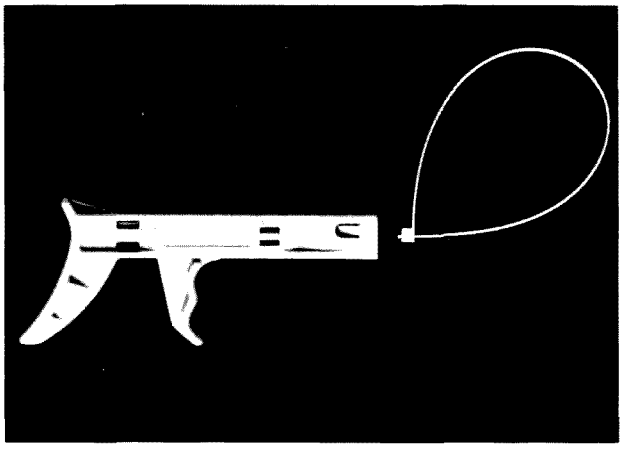
Aluma Tower offers trailer-mounted communication towers, ideal for mobile testing, site selection, and temporary installations. Available in up to 100-foot heights, the towers can be cranked up manually or with a 12-V winch. The trailers come complete with a 2"-ball hitch, spring suspension, and taillights.

For additional information about Aluma towers, contact the company at *1643 Old Dixie Highway, Vero Beach FL 32961; (305)-778-0606.* Reader Service number 158.

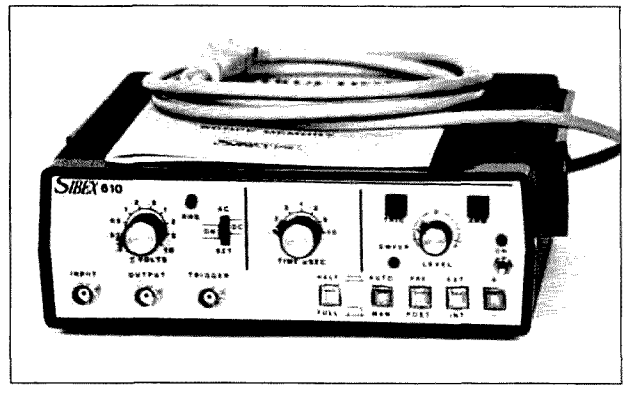
SIBEX SCOPE MEMORY

Sibex, Inc., has announced the model 610 oscilloscope memory. The model 610 has a 10-MHz maximum sampling rate and can store signals with a frequency of up to 1 MHz. Input sensitivity is 10 mV/division. The unit features pre- and post-triggering and a digital sweep function.

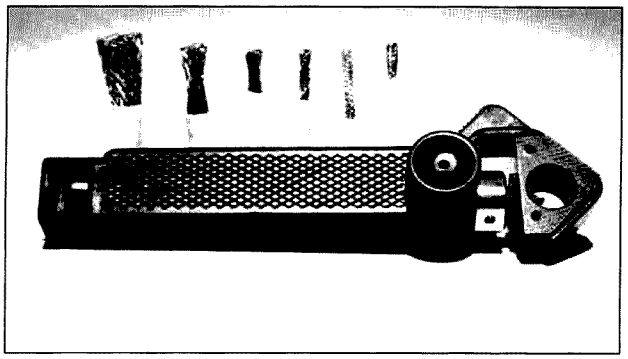
The model 610 memory unit is available for $985 from *Sibex, Inc., 3320 U.S. 19 North, Suite*



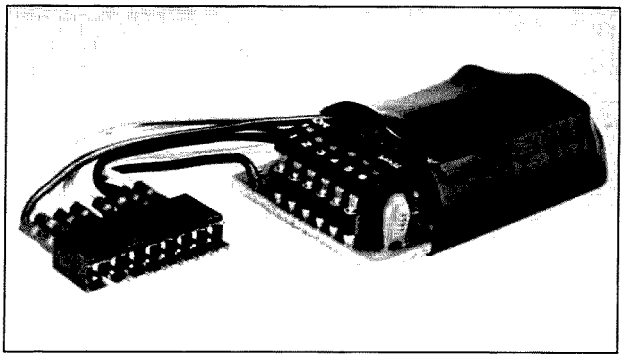
Cable-tie tool from Lynx.



The Sibex model 610 oscilloscope memory.



The CO-AX3 coaxial stripper by Davle Tech.



Selectone's ST-138W CTCSS encoder/decoder for Regency portable radios.

410, Clearwater FL 33519. Reader Service number 153.

BIRD BOOK

A new 60-page catalog of Thrulineoreg directional wattmeters, coax load resistors, calorimeters, and rf components is available from Bird Electronic Corporation. The catalog includes a comprehensive reference guide to rf measurement instrumentation and components from 2 milliwatts to 250 kilowatts in the range of 0.235–2,300 MHz, featuring triple-indexing by function, power level, and model number.

The publication is free—ask for GC-86 from *Bird Electronic Corporation, 30303 Aurora Road, Cleveland OH 44139; (216)-248-1200.* Reader Service number 160.

KENT MORSE KEY

R.A. Kent of Great Britain offers a solid brass Morse key in kit form. The machined hardwood base measures 8" x 3" x 1-1/2", and the solid brass arm is 6" long x 1/2" x 1/2". The key features ball race bearings and solid silver contacts.

For more information, please contact *R.A. Kent, 243 Carr Lane, Tarleton, Preston, Lancs PR4 6YB, Great Britain; (0774-73)-4998.* Reader Service number 161.

DAVLE TECH COAX STRIPPER

The CO-AX3 is a new coaxial-cable stripper designed for accurate removal of the outer sheath from twisted-pair coax and other irregularly shaped cables. A spring-loaded cutting head follows the contour of the cable, giving a precise cut to a specified depth. The cutting blade may be rotated 90 degrees to make a longitudinal cut, and a retractable ripping blade aids in splitting open cable insulation.

For more details, contact *Davie Tech, Inc., 2-05 Banta Place, Fair Lawn NJ 07410; (201)-796-1720.* Reader Service number 162.

NYE QRG DISPLAY

The Nye-Viking QRG Display is a VHF/UHF frequency counter with six big red digits which display your listening frequency. An automatic offset is built in for the 144-, 220-, and 440-MHz bands, with a remote switch for simplex or duplex operation.

The display is designed to be installed in the rear window of a car. The display remains dark until you transmit for at least four seconds, then the display will light up, showing the frequency you are listening on. The QRG Display can also be wired into the car's brake lights—six red eights appear when the brakes are hit.

For complete information about the QRG Display, write *Wm. M. Nye Company, 1614 130th Avenue NE, Bellevue WA 98005.* Reader Service number 163.

HAMTRONICS CATALOG

Hamtronics' latest catalog is ready for mailing. The 40-page, two-color catalog features many new products, including new GaAsFET preamps, a five-function DTMF decoder/controller, a T/R relay module, digital FSK modulators/demodulators for computer interfacing, and packet-radio VHF power amplifiers.

For a copy of the catalog, please send $1 ($2 for overseas mailing) to *Hamtronics, Inc., 65-F Moul Road, Hilton NY 14468-9535.* Reader Service number 164.

CTCSS ENCODER/DECODER

A new DIP-switch-programmable CTCSS encoder/decoder for Regency portable radios is now available from Selectone. The model ST-138W Digitone™ unit measures only 0.15" x 1.05" x 0.4" and comes wired with an 8-pin connector which mates with the tone-option harness in the Regency MCPH-, MCPU-, and NC-102-series portables.

The ST-138W draws less than 7 mA at 5.6 to 26 V dc and provides 38 CTCSS tones from 67.0–250.3 Hz. It includes a high-pass filter and crystal control for accuracy and stability.

You can receive more information about the ST-138W by contacting *Selectone Corp., 23278 Bernhardt Street, Hayward CA 94545; (415)-887-1950.* Reader Service number 157.

INTER-EAR COMM SYSTEM

Ace Communications, Inc., has augmented their line of in-the-ear listening devices to include a unit which also transmits. The IECS-200 replaces the speaker/microphone on an HT and allows hands-free communications in noisy environments. The IECS-200 will interface with any radio that has an external speaker and microphone jack.

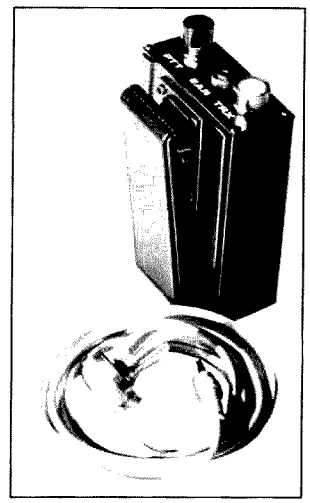
For complete details, write or call *Ace Communications, Inc., 22511 Aspan Street, Lake Forest CA 92630-6321; (714)-581-4900.* Reader Service number 155.

COAXIAL DYNAMICS WATTMETER, FS METER

Coaxial Dynamics has introduced two new meters to their product line. The 83000-A peak-reading wattmeter features a measuring capability of from 0.1 to 5,000 Watts in the 2–1,000-MHz range with plug-in elements.

The model 7600 field-strength meter offers high sensitivity, broadband operation, detachable antennas, adjustable gain control, and a large meter. Its frequency range is from 1 to 1,000 MHz.

You can get additional information on these and other rf products



The IECS-200 inter-ear speaker/microphone by Ace Communications.

by contacting *Coaxial Dynamics, Inc., 15210 Industrial Parkway, Cleveland OH 44135; (216)-267-2233 or (800)-COAXIAL.* Reader Service number 165.

R-2000 REPEATER CONTROLLER

Resultant Engineering has introduced the R-2000 microprocessor-based repeater controller. The R-2000 features an easy-to-use touchtone™ command language, over 30 user operations, a voice synthesizer which responds to your commands with interactive messages, a real-time clock, on-board subaudible-tone and DTMF decoders, autopatch, a mailbox and a bulletin board, two RS-232C ports, a watchdog circuit, and CMOS construction with battery-backed RAM.

For complete details, contact *Resultant Engineering, 175 East Homestead, Suite 5, Sunnyvale CA 94087; (408)-732-9482.* Reader Service number 166.

Kenwood TH-31AT

by Peter H. Putman KT2B

Trio-Kenwood
Corporation
1111 West Walnut St.
Compton CA 90220
Price class: $235



Photo A. The TH-31AT: "slight" of hand?

Oops! Now where did that handie-talkie get off to? Nope, not in my pocket, not in the drawer, not under the bed.... Ahhh, there it is. It slipped under the crack in the door!

Not to be facetious, but this is truly the smallest radio I've ever used. It sort of resembles a microphone with an antenna attached! Yet, the Kenwood TH-31AT will yield hours of operating enjoyment on 220-MHz FM.

This was truly an impulse purchase. While at the LIMARC hamfest on Long Island in February, I felt some money burning a hole in my wallet, so it was a short time before said cash and I were soon parted. I wound up with the basic radio plus an extra battery pack as a bonus from the dealer. In addition, I purchased a third pack for backup. I also bought the AJ-3 antenna-conversion plug (more on this later) as well as the DC-21 dc power converter. A Larsen magnetic mount and 5/8-wave whip rounded out the deal.

What's In It?

As soon as I opened up the box, I was amazed by the small size of the radio without the slide-on battery pack. With the standard pack, the TH-31AT measures in at 4-3/4" tall by 2-3/8" wide by 1-1/4" deep. That's not a lot bigger than a cigarette pack. In fact, the rubber-duck antenna is taller than the transceiver! The PB-21 battery pack measures in at 2-3/4" tall by 1/2" thick, so you can see that there isn't a lot of room for the guts of the radio.

Kenwood rates the radio at 1 Watt output across 50 Ohms in the high-power position. Using a Bird 43 and a 5-Watt 100–250-MHz slug, I measured 750 mW with three differently charged batteries. The supplied pack is rated at 7.2 volts, so I experimented with an outboard dc converter that supplied 8.5 volts, but no change was apparent in output. Low power is rated at 100 mW and this appears to be the case, based on the Bird measurements.

Battery life is estimated by Kenwood to be about 90 minutes using alkaline batteries with a 1-minute-TX/3-minute-RX cycle. How this relates to NiCd usage I don't know, but in my experience with a 1-minute-TX/3-minute-RX cycle, my batteries lasted about half an hour. Of course, I spend most of my time just listening, which made the batteries last considerably longer. I strongly suggest you use the DC-21 or some sort of outboard dc converter to save your batteries when you operate from the car or from home.

Here in the shack, I hooked up a Mirage C22 amplifier I had from a previous project to a dc power supply and connected an LM-317 adjustable regulator to the DC-21 battery connection. I set the voltage at 8 volts and ran the output of the TH-31AT into the Mirage amplifier. This feeds a KLM 7-element yagi on one of my two masts, and does an exemplary job of accessing local repeaters.

The TH-31AT is configured for simplex, −1.6-MHz offset and +1.6-MHz reverse offset, selectable from a tiny switch on the back panel. You shouldn't try to change the configuration while you're driving, however. Nor should you try to change the thumbwheel frequency selector while in the car. The Japanese must have incredibly tiny fingers! The thumbwheel isn't backlit, so you'll need to change it by feel in the dark or under low-light conditions.

The receiver is rated at 0.5 uV for 12-dB Sinad, and I wasn't in a position to challenge this claim. The unit is sensitive. It compares favorably with my Microwave Module, which has a MOSFET front end. Squelch sensitivity is rated at less than 0.2 uV and, again, I wasn't in a position to challenge the claim. The antenna connector is somewhat unique: It's a threaded RCA connector! I'm not sure why Kenwood settled on this type of plug, as a BNC jack really wouldn't have used any more room. Perhaps it's because the RCA connector presents a lower profile. But it will play havoc with an external antenna unless you purchase the AJ-3 adapter (threaded RCA to BNC female). With the AJ-3, you can use mobile antennas or hook into an external power amplifier.

Other features include an optional tone module for tone burst (TU-6), which is activated by a top-cover switch. The thumbwheels

tune in 1-MHz, 100-kHz, and 10-kHz steps, with a +5-kHz switch next to the tone switch. An LED keeps track of battery life and goes out when the voltage drops too low. Finally, connections for an external speaker and a microphone are found on the top cover, and Kenwood supplies an external speaker/mike (SMC-30) as well as a headset with VOX (HMC-1). Unfortunately, the plugs are reversed from the ICOM speaker/mike's and spaced further apart, so you can't cheat with another unit. Alkaline battery packs, a heavy-duty pack (SUM-2), and a charger round out the accessories. Boy, this can get expensive!

Operation

Now for the hands-on critique. The size definitely takes some getting used to. The controls are so tiny, for example, that you really have to look carefully to make sure you have selected the right offset. I'd also feel comfortable with a somewhat more responsive DTMF pad, as there is no tactile "click" when you depress the keys. Another complaint is the pressure needed to keep the PTT switch fully depressed. I have been in the middle of a QSO when the PTT dropped out on me, since I hadn't been maintaining a steady pressure on the switch. Again, this is due solely to the lack of a positive feel when depressing the switch. Whether this is a problem due to the size of the rig, I don't know.

The audio output is more than adequate for hand-held use (250 mW across 8 Ohms) but is not going to hack it in noisy mobile operation. An outboard power-amp module would be called for here. I use the unit barefoot into a Larsen 5/8-wave antenna with the DC-21 dc adapter and can work many repeaters full-quieting. This may be due to the fact that several of them have GaAsFETs in the front end, but, whatever the reason, it makes mobiling a pleasure. Since the radio isn't much larger than my Kenwood MC-45 microphone for my TR-7400, it's more like using a microphone—not an HT. Best of all, if you have to park your car in an unsafe area, the unit and dc converter can go in your coat pocket or briefcase. In fact, the TH-series HTs are ideal for traveling in general!

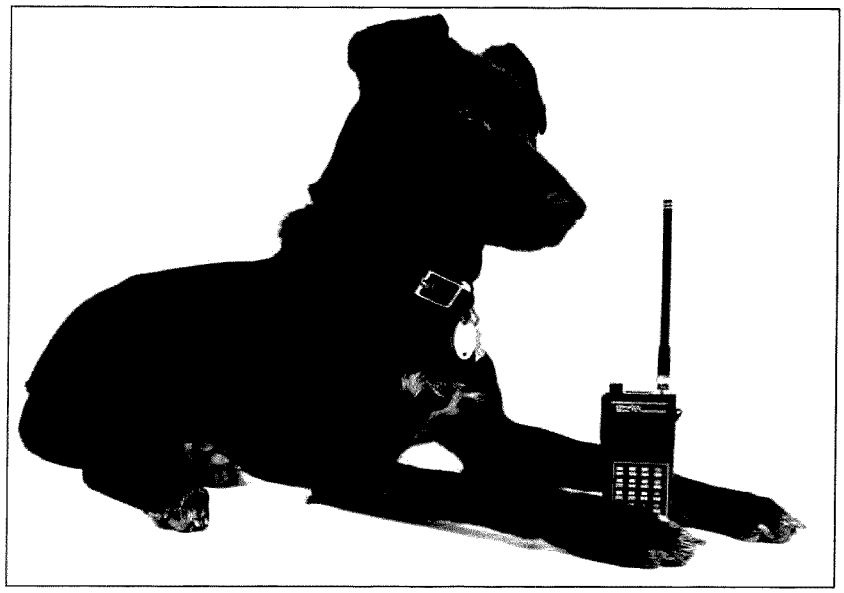


Photo B. "Crescent," my Labrador Retriever shows relative size.

To summarize, the Kenwood TH-31AT is a fun, easy-to-use radio for 220-MHz FM, although the controls may take some getting used to. The wide range of accessories makes it very adaptable for mobile and base-station operation, but you're likely to forget where you left it last due to its size! I suspect this would be a very popular radio with Novices should they ultimately get 220-MHz privileges. As for myself, the biggest problem is keeping the dog from using it as a toy and remembering not to sit on it when it's in my back pocket. One outstanding application for me is to use this HT as a low-power 220 communications link at large hamfests, such as Dayton, since the whole thing slips unobtrusively into a shirt pocket and the earphone is the only external connection. I also understand that Kenwood has now come out with a quick-charger that can hold two packs, and this can only add to the functionality of the radio.■

Heathkit HD-3030 Interface

by Marc Stern N1BLH

Heath Company
Dept. 150-735
Benton Harbor MI 49022
$199.95

There's an old saying in our ranks that goes something like this: "If you want to learn about the hobby, build something." It's a saying that had validity 30 years ago and that is still true today, to a large extent.

Of course, the kits of 30 years ago were large and complex and were state-of-the-art for the time, but they were kits you could really get your hands on because of the tubes and large components used. Contrast this with the kits of 1986, which feature integrated-circuit technology and printed circuit boards stuffed with tiny components. The difference is like day and night.

But, while it may not now be possible to build and debug each circuit—many of them are contained within IC flatpacks—kit building still gives you the chance to learn how a component functions within a specific overall device and how to handle IC components without fear. That, perhaps, is today's greatest lesson with kit building.

Thirty years ago, of course, one could attack each part of a circuit, check its performance, and improve on it. This was due to the nature of the components used. To a large extent, this defined the saying about kit building and learning. But those days are gone, and perhaps the primary reason anyone builds a kit today is not so much for a learning experience as for fun.

This is why I recently undertook the building of the Heathkit HD-3030 RTTY/CW interface. I enjoy kit building and wanted to add something to my shack that would increase its versatility, which the 3030 has done.

There was another reason I chose the 3030: It has been a couple of years since I last built a kit—no time really—and I wanted to handle something that wasn't overly complicated but that presented enough challenge to keep my interest. The 3030 came through with flying colors on both scores.

Organization

As you would expect, when the 3030 made its appearance here, I immediately ripped the box open and checked things out. The first thing I noticed was the organization. When I built my last Heathkit, everything was loaded into the box in a manner that made little sense. I had to sort through boxes and bags of resistors, capacitors, and diodes, as well as hardware and other goodies, and set things aside. Then I had to check everything against the manual, which was time-consuming.

The HD-3030, on the other hand, came well organized. The major subsystems were packaged together in the box, so all I had to do was



Photo A. The Heathkit HD-3030 RTTY/CW interface.

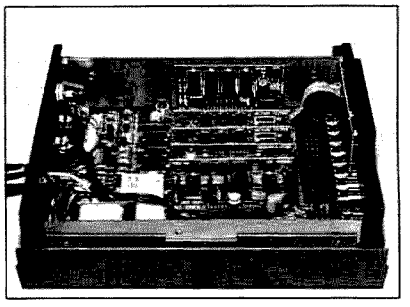


Photo B. The HD-3030 with boards intact.

move from subassembly one to seven, checking the components as I went. I then left each subsystem in its cardboard divider and went to work. This organization made things much easier, and I was able to jump into building this device quite quickly.

Construction

The first task was building the CW and RTTY demodulator boards, as well as the AFSK generator and the 2125- and 2295-Hz-shift boards, which give the 3030 its standard 170-Hz shift. These daughterboards are meant to plug into the motherboard via a 15-pin connector.

These boards took me about five hours to finish. I probably could have done them more quickly, but I took my time, not wanting to hurry things. Next, I moved on to the motherboard, which took me about another five hours in total.

At this point, I put the box together, made the required mechanical connections, and put the 3030 through its first smoke test. And, just as you'd expect, the smoke leaked right out of the device on the first go-around. I retraced my steps and everything looked as if it was correct, so I tried it again. This time nothing happened.

Well, I had to make the first of several calls to customer support. After I told them the symptoms and the findings of my own troubleshooting, they diagnosed the problem as lying in the voltage-regulator section. (Actually, I isolated the problem to one of the three regulators—7805, 7812, 7912—fairly quickly, and the customer service technicians at Heath confirmed my diagnosis, although none of us could figure out exactly what was going wrong.)

The upshot of this was that the call produced replacement components which were shipped promptly. The funny thing is that the same component kept on blowing all the time—the 7912—and although everything looked correct, it really wasn't. As I looked at the documentation for what seemed the thousandth time, I noticed there were two nylon screws included with the kit, but only one had been used. As I looked further, I noticed that one was supposed to have been used with the 7912. So, as usual, pilot error crept into the picture. When I put the new 7912 into position and replaced the metal screw that had caused the short with the nylon screw, the 3030 came to life.

Following the manual—once I had the device working, that is—I quickly aligned each board and set the 3030 up to work. Like all Heathkits, the manual is comprehensive and presents not only the building instructions, but also setup, alignment, and theory of operation. The documentation also includes a comprehensive breakout pictorial of each major subassembly and its construction, as well as a block diagram and schematic diagram. There are also X-ray views of each board.

Operation

Overall, the HD-3030 is a very competent interface with a good set of specifications. For example, the center frequency of the CW demodulator is 750 Hz, while the −3-dB bandwidth is 70 Hz. The −20-dB bandwidth is 240 Hz.

The 3030 is a universal interface in that it will work with a variety of personal computers. It just depends on the software you're using to drive it. Heath offers its own software, compatible with the H-8 and H/Z-89 computers, and many other programs are available for other personal computers. I used the 3030 with a public-domain IBM Personal Computer program, and it performed quite well.

Tune-up is easy thanks to the multi-segment bar-graph display. The front panel also controls choice of CW or RTTY and shift selection. The built-in shift is 170 Hz, although 425- and 850-Hz-shift boards are available as options, as is a preselector board that increases the sensitivity of the unit.

The 3030 is also compatible with TTL or RS-232 voltages, and a loop supply is a user option. The rear panel contains connectors for ground, an auxiliary ac output, the loop, and the interface connector.

The interface connector is a standard miniature DB-25 connector that Heath has used for its own purposes. It provides three RS-232-level outputs and inputs, as well as TTL-level outputs and inputs. There are also scope outputs for mark and space.

Altogether, I was quite impressed with the unit and the way it fit into my shack. But, there are a couple of aspects that I must comment on—the interface connector and the option boards.

Although I have no problem with Heath using a serial-type interface connector on the 3030 (a DB-25), I do have a problem with the way some of the input and output lines were implemented. Using the same connector for both inputs and outputs means you will have a tough time putting a cover on the connector body. The reason, quite simply, is the necessity of extra wire coming from the connector so that you can key the rig for RTTY or CW. It wasn't an easy task to cover the connector without crushing the wires. It would have been better if Heath had opted for RCA or phone-jack connectors for these outputs.

And I think Heath is unwise in offering the 425- and 850-Hz-shift boards as extra-cost options. In fact, I suspect this will probably hurt sales more than help because other units on the market are less expensive than the HD-3030 and offer the "standard" 170-Hz amateur shift and the commercial 425- and 850-Hz shifts as part of their packaging. You don't have to add it later or pay extra for it. In fact, other less expensive units have variable shift to 850 Hz. So, if you're thinking of this unit, be aware of the necessity for these optional boards, although I did find it will function quite nicely without them by using the mark frequency and tuning around it.

Overall, the HD-3030 is a competent unit that does offer a learning experience. No, you won't learn all about the hobby from it, but you will learn about parts of it and about the proper handling of integrated-circuit technology, something we must know in this day of microprocessors.

Reader Service number 150.■

Wayne Green W2NSD/1

How To Build A Great Ham Club

When ham club meeting night comes along, do you have a problem with priorities? Should you go to the club meeting or the dentist? Or perhaps a visit to your mother-in-law? Tough decision. The answer is to get the heck down to the club meeting and get the club off its collective ass. You can make the club so much fun the members will be fighting to have weekly meetings instead of monthly. Now stop sitting there wringing your hands, hoping someone else will do it.

Yes, I do a lot of things. You know why? Well, every time I look around and say to myself, gee, someone really should do something about so and so...I realize that, heck, *I'm* someone. So I go ahead and do it. It's amazing how much you can get done when you decide to do it.

For instance, I've been writing about your taking off a few weeks in October and coming on a little DXpedition to Asia with me. You know it would be a lot of fun, but you aren't into making big decisions like that. Phooey. Sure, I know, you're a bit tight on money—and you don't know if they'd let you take that much vacation. I'm sure you can come up with a half-dozen good reasons for not doing something. My friend, you only have one trip through this life, so isn't it time you started making some decisions which will add to your life? I'm going to have a ball in Asia and you should be there with me having fun.

Show Biz

Okay, let's apply that concept to getting your ham club going like gangbusters. I said to stop wringing your hands—let's get to work on this. The first thing you have to understand about ham clubs...about any clubs...is that you're in show business. It's basic—if the members don't have fun they aren't going to come back. Think about it.

What's fun to do at radio club meetings? One fun thing is to get to talk with your fellow hams. Have you built that part into your club meeting? Give 'em some refreshments about half way through the meeting and maybe twenty minutes to chew the rag. Coffee and assorted doughnuts are good fare...or fresh cider and doughnuts. Have you an XYL or two in the club who can make a homemade coffee cake?

A meeting can be made fun if you can find a good speaker. Is there a ham manufacturer or dealer within reasonable commuting distance of your club? Ask him to come in to show and tell the members about his product.

A hint on the care and feeding of speakers...take care of them and feed them. Get maybe three or four members of the club to have dinner with the speaker before the meeting. Pay for his dinner, you tightwad. If you're driving him to the meeting from the restaurant, you might have a two-meter rig in the car with the members talking up the meeting over the repeater. This will give him the impression that you have a live group.

"At least one club member must have a Macintosh by now. Quickly elect him editor of the club newsletter."

Once you're at the meeting place be sure that many of the members come up to the speaker and introduce themselves to him—perhaps with some compliments on his product. Get him off to a good positive start. I hate to think of how many club meetings I've been to where the members all were busy talking with each other and ignored me completely. Start the meeting on time.

How do you get the slow arrivers to stop straggling in late? Hold the door prize drawing first instead of last. A couple times missing the drawing and you'll find 'em remarkably punctual.

If you really must have a business meeting, keep it to under ten minutes. You should do this anyway, for nothing kills a club like extended business meetings. No good can come of it. Let the executive committee handle the business and give the club a fast report.

If you want your speaker to be interesting he has to be the star for the evening. Get him on early. Take the time to give him a good introduction. Give him any help he needs to demonstrate his product.

If you've a shortage of ham industry people in your area you should look around for ham fanatics to show and tell. Check out your members for any known DXers, packeteers, SSTVers, RTTYers, moonbouncers, meteor scatterers, microwavers, OSCARers, certificaters, contesters, builders, traffic handlers, and so on. Lift up the local rocks and see what crawls out.

I've seen some great DXpedition slides, and heard interesting talks on just about every ham fetish. They're out there if you'll beat the bushes. And don't dump the problem on the program chairman...get the whole club to scrounge.

Can you get some Novices and Techs to come to the meeting a half hour early for a short technical talk and perhaps ten minutes of code practice? This is a good way to help newcomers get licensed—and club members move up the ladder more easily. The club has to be fun...but it should also be supportive of the members. The club is where you provide the peer pressure to get 'em to get a higher class ticket. It's where you get more and more members to try new aspects of the hobby.

Keep 'em Short

Now, after the speaker and the Q&A...and then after the feeding frenzy...it's time for some reports. Short reports. This is the time for the TVI committee to report on its activities...the licensing committee on new and upgraded licenses...the school radio club Elmering committee...the self-policing committee on recent complaints...the program committee on upcoming entertainment...news of club activities such as an auction, flea market, picnic, mountaintopping party, Field Day effort, and so on. How about organizing groups to drive in a caravan to major hamfests and conventions?

At least one club member must have a Macintosh by now. Quickly elect him editor of the club newsletter. Help him set up the reports

he's going to need and the deadlines for the reports. You want to build interest in ham activities so get in reports on packet action, DXing scores, contest scores, antenna erecting parties, OSCAR contacts, and so on.

Does anyone in your club have a video camera? Great! Get him to do a video of the club activities. Get him to visit members and make a video of their stations. If the club has some fox hunts you can make a fun video of the hunters. If you don't have fox hunts, why not? A short video will brighten up a meeting. If you don't have someone with a video and another member with a Macintosh in your club, you're badly in need of some new blood.

Growth Mode

How can you get new members? Easy... the club newsletter is a good sales tool. Get someone with a computer to make a list of every ham in the *Callbook* in your zip code areas and start sending them the newsletter for perhaps four issues with an invitation to come to the next meeting. You might even tell them what fun they will have when they come. Remember, as I said, you're in show business now. Once you get them to their first meeting, be sure you have a committee to spot them and make a fuss over them. Introduce them during the meeting. Make them special and they'll be back.

You can't afford to send free newsletters to a zillion inactive hams, so rotate the free copies as you can afford. It wouldn't hurt to have club members take lists of the potential members and give them a call with a personal invitation to come to a meeting.

At meetings you can ask members to make a list of every ham they hear in the area who should be invited. This will help you pick up many which aren't listed in the *Callbook* yet. It'll give you a first-class mailing list, too. These chaps are active hams, so they'll probably be an easier sell than someone who hasn't turned on a rig in ten years. Make sure club members talk up the club on the air and invite everyone they talk with on the air to the next meeting.

Be sure to put a small poster in any local ham dealer store. You'll want to have posters in the local high schools, too. Your newspapers will list your meetings, complete with a short story on your speaker. Cut out a copy for the speaker and give it to him. It'll help his ego.

Does your neighborhood have any bulletin boards? Get your posters up there, too. How do you make posters? Get that kid with the Macintosh, he'll be happy to oblige.

Have you thought about organizing some club outings? You might get a group together to visit a TV station... an observatory... an electronics plant... an FAA station... a research lab. You'll probably find at least one member with an in for such a visit.

Now Get Going

Okay, I've primed the pump... now I expect you to take the ball. If you have any ideas on how to get clubs perking, send them in so I can pass your ideas along... and give your club some credit.

Oops, I almost forgot. If I'm speaking at a club I ask for no smoking... and generally get a round of applause for it. Why not ask your nicotine addicts to indulge in their drug habit outside? Nicotine is a poisonous oily substance gotten from tobacco leaves... named after Nicot, a French diplomat who introduced the drug to France.

I've run into a few clubs who encourage the use of alcohol, passing around cans of cold beer. Another drug with millions of addicts. Let's keep drugs out of club meetings... alcohol, nicotine, pot, and cocaine. Why do kids think it is so cool to be drug addicts? Phooey... none of these drugs are going to improve your meetings.

I'm going to get working on some videos of my talks which might help fill in a few minutes for your meetings. I'll let you know as I get 'em ready. I've got a couple of the new 8mm cameras, so it won't be difficult. I'll do 'em on 8mm and then dub them to VHS for you.

If your club can put together an interesting video you might let other clubs know you have it available via *73*. I've seen some remarkable home movies of club activities in the past... now it's time to do these with video so we can inexpensively distribute them. What can your club do which will make an interesting video for other clubs and for showing at hamfests?■

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Dallas Williams WA0MRG
PO Box 1
Sedgwick CO 80749

Roll A RTTY Scope

An oscilloscope is still the best way to lock on to a teletype signal. Building one is easier than you think!

One of the most common complaints voiced by newcomers to radioteletype is difficulty in tuning the signal. It doesn't take long to realize that watching a couple of flashing lights and tuning for "good" copy is, at best, a haphazard method.

Over the years a number of schemes have been introduced to aid the tuning process, including dancing meter needles, LED bar displays, and various forms of digital and analog converters. Compared to the old reliable oscilloscope, however, they seem to leave a lot to be desired. The scope can tell the accuracy of the received shift. It will also give a very accurate indication of the tuning. For those of us who prowl the commercial RTTY channels, the scope is invaluable. It will, for instance, show at a glance the difference between a 375- and a 425-Hz-shift signal. In spite of the simplicity and accuracy of the oscilloscope, it is amazing how many RTTY operators have never used one.

Of course, it must be said that the oscilloscope will not work with all RTTY demodulators. Demodulators or terminal units (TUs) that do not have separate mark and space channel filters cannot use a scope for tuning purposes (at least not in the form described here). How can you tell? Look for output connectors labeled "oscilloscope" or, failing that, look at the schematic diagram. Nearly all demodulators that have separate mark and space channels or filters will be similar to the block diagram in Fig. 1. Older units may



Photo A. Left to right: surplus CRT shield and mounting bezel, 2-inch CRT, 3-inch CRT.

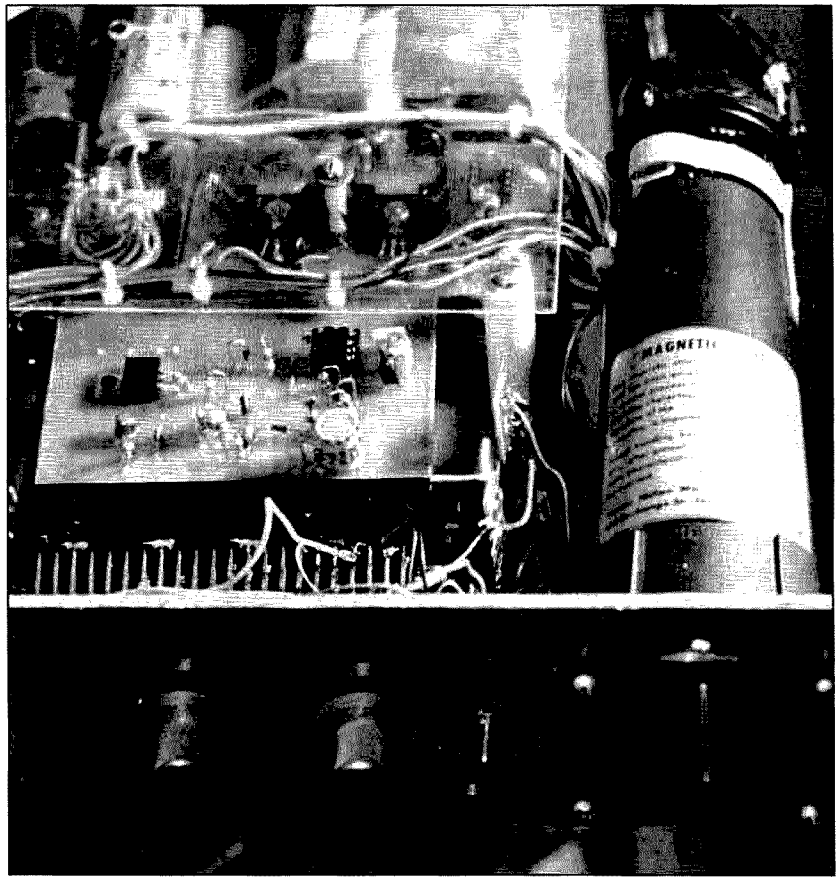


Photo B. The RTTY scope mounted in a home-brew TU.

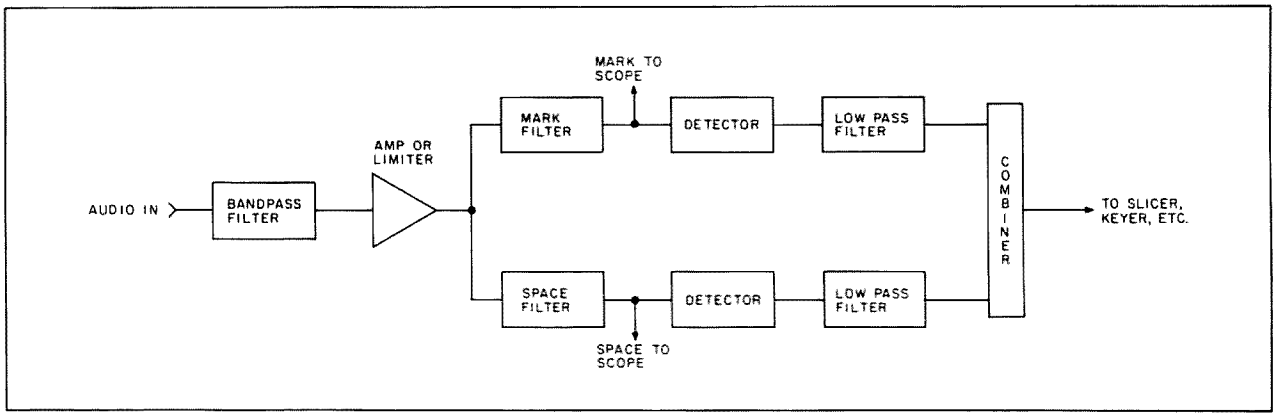


Fig. 1. Block diagram of the audio stages of a typical RTTY demodulator.

have toroidal coils and capacitors for the filters rather than operational amplifiers or switched capacitors, as is the current trend. In either case, the important thing is separate filters for mark and space. Some demodulators will have more than one space filter, the other filters being switched in when tuning different shifts.

Adding a Scope

Assuming that your TU can use a scope, there are two ways to go. The easiest is to hook up a standard oscilloscope. They can usually be found for $5 and up at swapfests. Nothing fancy is required. The only important thing (other than it being in working order) is that the scope have an external horizontal input. Nearly all do.

"In spite of the simplicity and accuracy of the oscilloscope, it is amazing how many RTTY operators have never used one."

The space-filter output is coupled to the scope's vertical input, and the mark-filter output is fed to the horizontal input. I have had no trouble doing this using plain hookup wire. However, it would probably be wise to use shielded cable. Place the scope's horizontal control in the external position. If the TU has a limiter, turn it on.

With the scope and demodulator turned on, adjust the scope controls until a dot appears in the center of the scope tube. Now feed a mark signal into the demodulator. You should see a horizontal line on the scope tube. If not, then adjust the horizontal gain until a line appears across the face of the tube. Many scopes are a bit short on horizontal gain, and you might find that the trace will not cover the entire face of the tube.

Next, feed a space signal into the TU. A vertical line should now appear on the scope. Adjust the vertical gain until the line is the same length as the mark display.

That's all there is to it. When tuning in a RTTY signal, the lines on the scope will assume a more oval shape due to the mark and space filters. The narrower the oval is, the narrower the filters being used (assuming no change in shift).

Roll Your Own

The second way of adding a scope to your RTTY setup is to build your own. It is neither difficult nor costly. Your own scope will have the advantage of being smaller than a regular oscilloscope, which means it can be built inside a present TU.

A basic RTTY scope consists of the CRT (see Photo A), centering controls, horizontal amplifier, vertical amplifier, and power supply. The actual scope circuit (see Fig. 2) has

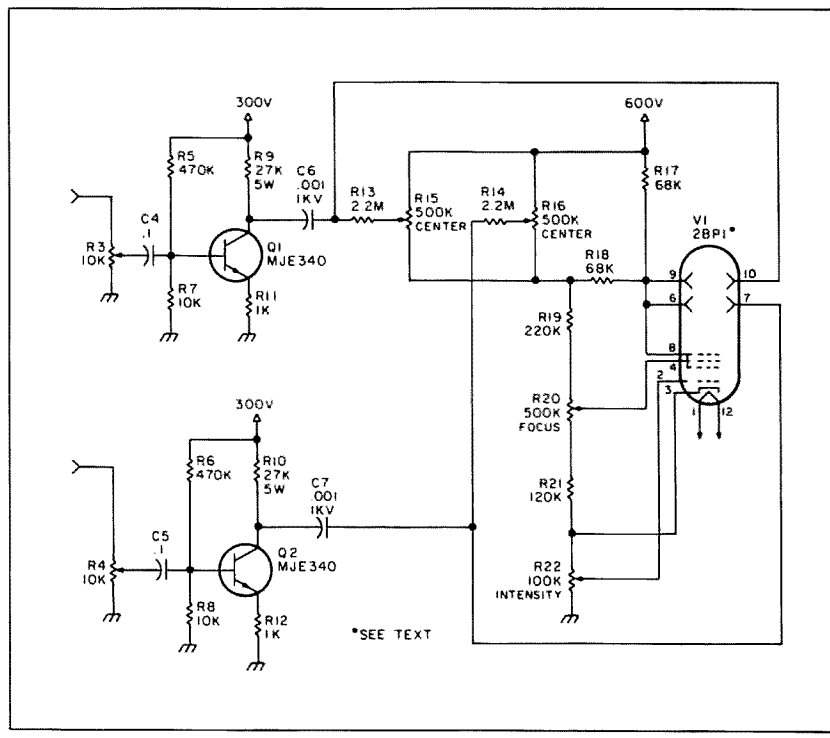


Fig. 2. RTTY tuning scope.

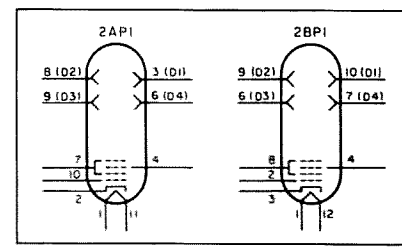


Fig. 3. CRT basing diagrams.

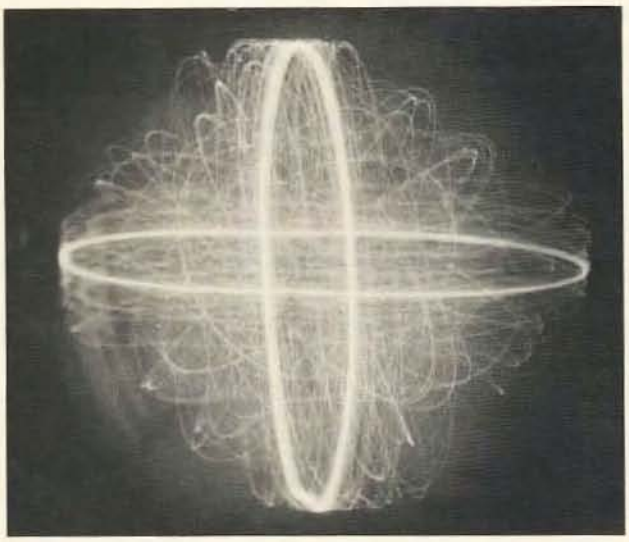


Photo C. A 170-Hz-shift RTTY signal, as displayed by a scope. Compare this with Photo D.

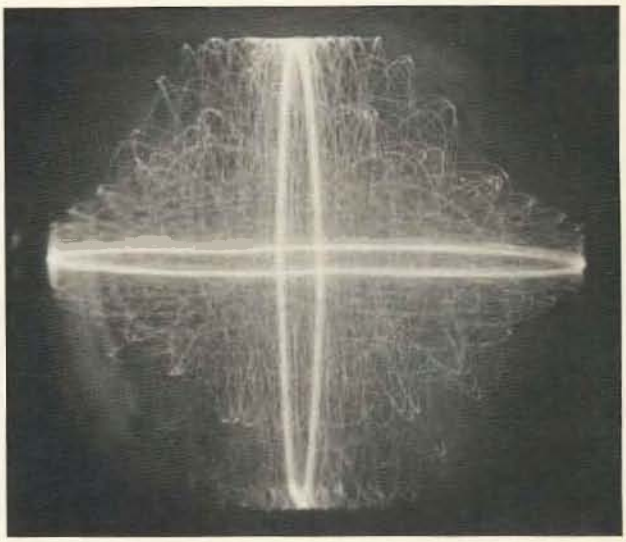


Photo D. A 425-Hz-shift signal. The filters used have the same bandwidth and gain as those used.

been around for years and is a standard with old-time RTTY fans.

Amplifiers Q1 and Q2 are required because the output of the demodulator filters is not great enough to give adequate CRT spot deflection. With the power-supply voltages given, the two one-transistor amplifiers used in the circuit have more than enough gain for full deflection when driven with op-amp-type filters having outputs greater than about 3 volts peak-to-peak.

Because the scope input impedance is somewhat low, it could cause undue loading of the filter and detector circuits of some demodulators. This could be overcome by adding a high-impedance voltage-follower stage to drive each amplifier.

A word of caution: The voltages in this circuit are dangerous and a simple accident could be fatal. *Use extreme care.*

Parts

The CRT shown is a 2BP1, but a 2AP1 will work just as well—though it has different pinouts and requires a different socket. Fig. 3 shows the basing diagrams for the 2BP1 and 2AP1.

The 2B-- series CRT was manufactured with several phosphor types, including P1 and P11. The P1 phosphor in the 2BP1 is the common green. The rarer P11 (2BP11) yields a blue trace. There is no other difference between the two CRTs.

The CRT you use will most likely be determined by availability. Small CRTs are sometimes hard to locate. If you happen to locate a 1-inch tube, then use it. Some 3-inch tubes can be used, but they are longer and take up far more space than is really necessary.

Finding the necessary components will probably be the most difficult part of building the scope. In this day of solid-state and microcircuits, higher voltage and power components are expensive and sometimes hard to locate. A quick check showed the 2BP1 priced from $10 to $75 in "used" condition; so if you buy the parts, careful shopping is advised. Many times you can locate a surplus scope foundation for a price that is less than the cost of the CRT alone. Some used CRTs may show trace burns, but unless the burns are serious the tube is probably still usable.

While a mu-metal shield for the CRT is not absolutely necessary, it will protect the scope display from being distorted by stray magnetic fields associated with the power transformers. The shield also simplifies the mounting of the tube. A surplus scope foundation will have not only the tube and shield but also the socket and usually a mounting bezel. These can be removed and placed in a new box or panel, making an attractive display.

An alternative would be to make a bezel from a circular meter by removing the meter movement and the back of the case. Replace the meter glass with green plastic. A separate shield can be purchased from a surplus dealer.

Care should be exercised when inserting the CRT in the socket. Many of these older tubes suffer from poor bonding between the glass envelope and the Bakelite™ base. One wrong twist or push could ruin the tube.

The collector load resistors in the vertical and horizontal amplifiers should be 5-Watt units. They do get warm and should be mounted in a reasonably open space.

Since the scope draws so little current, only half-wave rectification is used in the power supply (see Fig. 4). Transformer T1 secondary voltage is not very critical and just about anything between 150 and 250 volts each side of center tap will work. The low-voltage output from the power supply should not be greater than 300 volts, otherwise the

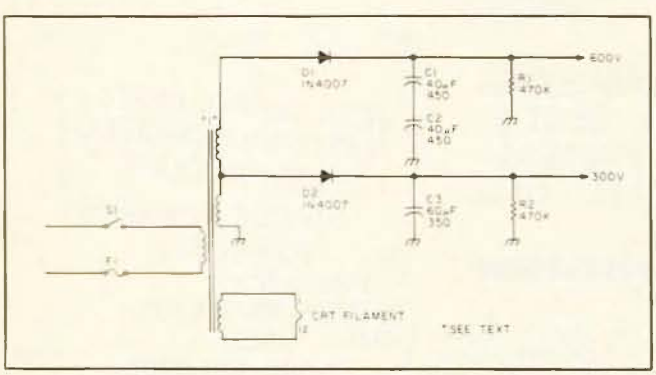


Fig. 4. Power supply.

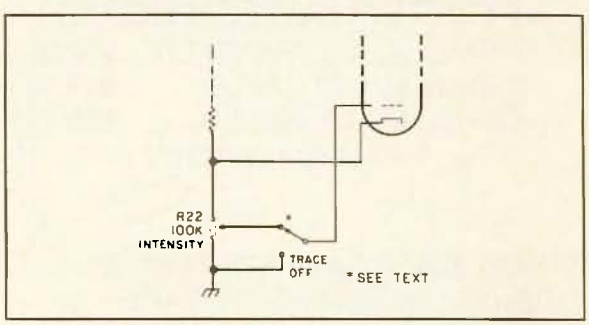


Fig. 5. Optional circuit to turn off scope trace

ratings of the transistors may be exceeded. A transformer from an old tube-type radio will probably work fine. The one used here came from a defunct chart recorder. If the T1 chosen has a 6-volt filament winding, it can be used for the CRT (assuming the CRT has a 6-volt filament) rather than using a separate transformer. Both the 2AP1 and 2BP1 have filaments rated at 6.3 V at 0.6 A. (Don't overlook the possibility of tapping into the transceiver's high-voltage supply—if it has one.)

The value of the power-supply filter capacitors given in Fig. 4 is just about the minimum that can be used. More would be better. Be sure that the voltage rating is greater than the supply voltage. Some series-parallel combination will probably be necessary to achieve the needed values. If, after building and testing, the scope trace shows some ghosting, then an increase in the low-voltage filter capacitance is necessary. I started with 30 uF but found that 60 uF gave a better trace.

Only the intensity control needs to be mounted in a convenient place. Once the other controls are set, they should not need to be adjusted again; thus, they can be mounted inside the unit. The intensity control can be backed off during standby periods, preventing burning of the CRT. As an alternative, a DPST switch can be wired across the intensity control to turn off the trace during idle periods (see Fig. 5).

Nothing in the circuit is critical, so just about any layout and construction method can be used. The transistors should have heat sinks. Don't forget to use heat-sink compound and insulating kits. Remember, there are up to 300 volts on the collector of each transistor.

It is a good idea to locate the transformer as far away from the CRT as possible. If the CRT trace is distorted by stray magnetic fields from the transformer, try rotating the transformer slightly.

Tune-Up and Hookup

Tune-up is just as before, although at this point it makes little difference which amplifier is mark and which is space. After connecting the scope to the TU (Photo B), set R3 and R4 to the middle of rotation and adjust the scope controls for a fine spot in the center of the CRT. If the spot does not focus to a fine dot, then it is probably being distorted by stray magnetic fields from the power supply.

Now feed a mark signal into the TU. A line should appear on the CRT. The line will probably not be horizontal but rather at an angle. Loosen the CRT mount and carefully rotate the scope tube until the line is horizontal. Adjust the associated gain control until the line crosses the entire CRT face when the input signal is maximum. Any further increase in the input signal should not cause the CRT display to expand.

Using a space signal, adjust the remaining gain control in the same fashion for a vertical trace. The RTTY scope is ready to use.

Parts List

C1–C3	60 uF, 450 V, electrolytic (see text)	$6.00
C4–C5	.1 uF, disc ceramic (RS 272-135) (J)	.59
C6–C7	.001 uF, 1 kV, disc ceramic	.18
R1–R2	470k, 1/2-Watt resistors	.19
R3–R4	10k linear pots (RS 271-1715)	2.18
R5–R8	1/2-Watt resistors	.38
R9–R10	5-Watt resistors	1.00
R11–R14	1/2-Watt resistors	.38
R15–R16, R20	500k linear pots (RS 271-210)	3.27
R17–R19, R21	1/2-Watt resistors	.38
R22	100k linear pot (RS 271-092)	1.09
Q1–Q2	MJE 340 or equivalent	2.64
D1–D2	1 Amp, 1,000 V, 1N4007 or equivalent (J)	1.49
T1	Primary 110 V, Secondary 150–250 V c-t (F) (see text)	
S1	SPST miniature toggle switch (J)	1.49
S2	SPDT miniature toggle switch (J) (see text)	1.49
2-inch cathode ray tube (CRT) such as 2AP1 or 2BP1 (T, F) (see text)		
Socket for CRT (F) (see text)		
Shield for CRT (F) (see text)		
Mounting bezel for CRT (F) (see text)		
Heat sinks for Q1 and Q2 (RS 276-1363) (J)		1.58
Misc.—Fuse (1/4 A), fuse holder, line cord, terminal strips, hardware, cabinet, knobs, etc.		

Possible Sources:

Jameco (J)
1355 Shoreway Road
Belmont CA 94002

Radio Shack (RS)

Fair Radio Sales (F)
PO Box 1105
1016 E. Eureka Street
Lima OH 45802

Typetronics (T)
Box 8878
Ft. Lauderdale FL 33310

The Display

Over the years, numerous drawings and an occasional photograph have been published showing the patterns displayed by a RTTY scope. Unfortunately, many of these are based on a "perfect" system; they sometimes have little resemblance to the traces seen in real life.

What the scope shows is, of course, determined by the filters in the TU and the shift being tuned. The wider the filters or more narrow the shift, the more oval the scope traces become (see Photos C and D). This is caused by lack of complete mark and space channel isolation.

The scope also will show a number of faint traces around the main ovals. These traces are caused by the mark-space frequency transitions of the received signal; the change from mark to space is not instantaneous. The narrower the filters or the higher the keying speed, the more pronounced these secondary traces become. Since minimum usable filter bandwidth is directly related to the keying speed, a point can be reached where the scope will not give an adequate display for tuning. But the TU could not handle the signal anyway.

Ideally, when a signal is properly tuned the ovals will form a perfect cross. However, if the shift being received is not quite accurate, then when the mark signal is properly tuned the space trace will not be perpendicular. Instead, it will be rotated clockwise if the shift is too narrow, or counterclockwise if it's too wide. (Some commercial scopes will show an opposite rotation.)

Also, some filters and limiters introduce phase shifting, making a perpendicular display nearly impossible to achieve. Another form of phase shift produces ovals that look more like figure eights. In my case, this latter form of phase shift is caused by over-driving the input of the TU and is easily cured by turning down the receiver audio.

If the phase shift is taken into consideration, the scope will still work quite well. Of course, phase shift can be corrected by the addition of a "phaser circuit," usually consisting of a resistor-capacitor combination in series with the scope input.

Monitoring your own signal and using the scope as a spotting indicator is a good way to make sure you are on the other station's frequency. With the use of MSO operation, this is very important.

After a few hours of using the RTTY scope, you will probably wonder how you ever got along without it. ■

CLUBS

Joseph Nardo WD6R
231 Timber Road
Newbury Park CA 91320

Bozo And The B-Hunt



Want to light a fire under that snoozing group of old-timers you call a club? Want to put some fun back into ham radio? Want free beer? Read on.

You are likely to hear some very strange transmissions if you are traveling through Southern California monitoring the WA6OBT 147.285/.885 repeater. How strange? Here are three recent transmissions:

"The music stopped; the lady died."

"If you are near the Inn, you can see my grin."

"A man was convicted of a crime; the judge set him free; you would have too."

As you listen more carefully, you begin to hear many questions being asked in rapid succession. Only a simple "yes" or "no" is heard in response. The questioning becomes so heavy that stations are heard doubling or tripling with each other as each excitedly tries to ask a question.

"What in the world are you listening to?" your companion asks.

You have just encountered either an exciting B-hunt in progress or the challenging Riddle Night, two very popular activities which have sprung up on Larry King's repeater (known affectionately as Bozo).

In just a few months, these unique activities have renewed old companionships, introduced new friends, and are providing an opportunity for members of the Conejo Valley Amateur Radio Club (CVARC) and other users of the WA6OBT repeater to meet on a regular basis both on the air and in person.

The Birth of the B-Hunt

Locating hidden transmitters via use of two-meter amateur radio, more popularly known as T-hunting, is a sport which has been around a long time. The object is to find a hidden transmitter through the use of a special direction-finding antenna, attenuators, a map, and a compass. A keen sense of direction, a competitive spirit, and a calculating mind also help. The traditional T-hunts have been a monthly event in the Conejo Valley area.

During a discussion on the air one evening, I offered a challenge for a different type of T-hunt. Instead of the usual equipment, a different set of skills would be required to locate the hidden transmitter. A series of clues would be given which, when solved, would lead the hunters to the hidden transmitter. The first operator to find the transmitter would be treated to a beverage of his or her choice, hence the name B-hunt.

> ***". . . the company of friends and famiiies was the best part of a creative hunt."***

The response was quite positive as the word spread of the upcoming activity.

"When is the B-hunt going to start?" was heard as stations gathered on the specified evening. People were actually showing up to participate!

The hidden transmitter operator finally announced his arrival on frequency. The rules were read and the first clue was given.

There was no hesitation as questions began to fly in an effort to solve the clues as quickly as possible, with each participant trying to be the first to locate the hidden transmitter. Clues were given every five minutes. A new clue was given only after the previous clue was solved.

Within approximately thirty minutes a winner arrived, a husband and wife team, no less, to find the hidden transmitter in the parking lot outside a local watering hole. It was decided to use the parking lot for the first hunt since it might have been a disturbing sight to see someone sitting inside the establishment talking into a "police-type" radio, suspiciously responding yes or no over and over.

The hunt continued for the other participants. Once the hunters moved inside, the owners and other patrons became quite interested in the activity, asking many questions about the hunt and amateur radio.

From B-Hunts to R-Hunts

B-hunting proved to be an instant success. Another hunt was quickly scheduled for the next week, with the winner of the first hunt responsible for "hiding" the next week. At the conclusion of the second B-hunt, there was a discussion about expanding the hunts to include XYLs and other family members. The B-hunt quickly changed to an R-hunt, a restaurant hunt.

When the R-hunt began, wives, children, and friends joined in the fun. Again, the rules were reviewed. Clues were given and eventually solved, and we all wound up at the local pizza parlor, enjoying good food and company and swapping "war stories" of the hunt.

LMNOP Night

The B-hunts and R-hunts not only grew in popularity but also soon generated some very creative thinking. Finding new locations along with developing challenging clues was turning out to be as much fun as the hunt itself and led to a new wrinkle, an LMNOP Night.

Curiosity over what an LMNOP Night might be caused much speculation. Inquiries and guesses flourished on Bozo. One operator thought he actually had it figured out long before the event was to take place.



Hunt night finally arrived. Many anxious operators were awaiting the first set of clues. The hidden operator announced his arrival. The rules were reviewed and the first clue was repeated: "LMNOP."

After approximately one hour and dozens of questions, LMNOP was finally unraveled—"Light Meal Night On Potatoes!"

That was only the beginning. Somewhat mistakenly, the questions centered around attempting to identify a specific restaurant which specialized in potatoes. There are restaurants that specialize in pizza, pancakes, fish, or hamburgers, but potatoes? That was a tough one!

Additional clues were given:

"If you are near the Inn, you can see my grin" was quickly cracked by one operator. Soon, the first arrival was announced. The search continued with additional questions and clues; each succeeding clue was a little more revealing and helpful. Other arrivals were announced.

Finally, the last clue did it for the less fortunate hunters:

"Some call it home; ever be it so humble; it may not be neat but ever so sweet."

The "restaurant" was not a restaurant—it was the home QTH of Ray WB6HDG and Nancy WA6PRW Biederman. And what a delightful meal it was, of potatoes, sour cream, chives, cheese, wine, vegetables, etc. Again, the company of friends and families was the best part of a creative hunt.

And Riddles, Too!

"Riddlistics" is generating considerable interest and participation on Bozo, too; it began almost simultaneously with the unusual alphabet hunts. One evening I asked if there was interest in solving a riddle. The adventuresome group replied, "Let's go!" I gave the riddle:

"The music stopped; the lady died."

As with the hunt clues, only yes or no questions could be asked, with the object being to figure out the situation described by the riddle. After approximately two hours and nearly 100 questions, the riddle was solved.

The solution? This riddle describes a circus act in which a blind female tightrope walker uses the music of the band to tell her when she is at the end of the rope walk. When the music stops, she knows she can then safely step onto the platform which is directly in front of her. Unfortunately, one evening the music stopped a few beats early and, thinking she was at the end of her walk and near the platform, she stepped off early and fell to her death.

Riddle Nights not only challenge local hams but they attract other hams from neighboring communities. Mobile operators passing through the area have joined in as well. Riddle Nights now occur at a moment's notice. Some riddles have been solved within five minutes. Others have taken several hours. Any riddle is welcomed. Some have been quite challenging. Others have bombed.

Some Simple Rules

To make the activities both challenging and enjoyable for all participants, a few simple rules have been developed:

Foremost, all proper conventions of legal operation must be observed. Timely station identification is a must at all times.

The repeater always remains available for emergency traffic or other regular use, as needed.

Good taste is always practiced.

Only questions which require a yes or no response are permitted for both the hunts and riddles.

Questions regarding geographical locations are not permitted for the hunts, e.g., "Are you east of Main Street?"

No direction-finding equipment is permitted.

For the hunts, approximately seven to ten clues are prepared and given in decreasing order of difficulty. Developing challenging clues has been as much fun as the hunt itself.

New clues can be given only after the previous one has been solved or clues can be given every five minutes or so to speed up the hunt, if time is a factor.

No one is excluded. Many new friends have been made as a result of the hunts and Riddle Nights.

Locations are not given away by the winners. Once the hidden transmitter has been located, the hunt continues. Everyone is encouraged to find the location. Getting together has been the best part!

If someone solves a riddle quickly, a phone call is made to the "riddle control operator" to check out the answer, thereby not giving the solution away over the air. In fact, one riddle was solved in five minutes by one person and it took others over an hour to come up with the answer. Phone calls keep Riddle Night going for the other participants.

Join the Fun

Riddle Nights and the alphabet hunts are easily adaptable to any community. They may be just the thing your area or club could use to generate some interest among your repeater users and to encourage more frequent friendly get-togethers.

If, by chance, you pass through the Conejo Valley area and are monitoring Bozo (147.285/.885)—be prepared. You may hear a riddle in progress and be tempted to join in. Do so!

Get Started

Interested in getting your area started? How about starting with this very challenging riddle:

"A blind man walked into a restaurant and ordered albatross from the menu. When it was served, he asked the waiter if it really was albatross. The waiter replied yes; the man took out a gun and shot himself."

An SASE will get you the answer. ■

CLUBS

Richard A. Balser KB6HQS
17955 Medley Drive
Encino CA 91316

HAMS Against Drunk Driving

A tragedy spurred KB6HQS into action against drunk drivers. He explains how you can use your amateur talents to help clean up the highways.

I am a 17-year-old senior at the Oakwood School, a small private high school near Los Angeles. I have had my Advanced-class license since August of 1985. I have always been fascinated by ham radio, and I've always tried to use my ham skills to their fullest potential. When I started my senior year in September of 1985, many people at my school knew about, but did not really understand, my special hobby. I was looked upon mostly as a "science enthusiast." There was a girl at school with interests totally different from mine—she was enthralled by the theater and the arts, and she wanted to become an actress. Her name was Alexandra Vincent, and she was one grade level below me.

On Monday morning, February 24, 1986, we learned of a tragedy that had taken place overnight. Alex had been traveling on a local freeway at about midnight when a problem developed in her car. She pulled over into the emergency lane, turned on her emergency lights, and then phoned her mother and a towing service. After both had arrived, Alex needed to present her emergency road service card. As she leaned through the front left window to reach for her purse, a white Blazer—driven by a drunk man who had twice before been convicted of drunk driving—crashed into her car and instantly killed her.

It is not possible to write about the grief felt for Alex, or the anger and hate felt for the man who killed her. Everybody at our school was devastated and bewildered by Alex's death, yet the student body soon channeled its negative feelings into the formation of a chapter of SADD (Students Against Drunk Drivers). It was more difficult for me. I felt as if I belonged to the amateur community more strongly than anywhere else, so I wanted to do something using amateur radio to commemorate her, to channel the hate I had for the drunk driver who took Alex's life into something positive. Perhaps ham radio could be used to prevent other people from being killed by drunk drivers.

In the weeks after Alex's death, I devoted all the time I could toward forming a group of amateurs who would voluntarily report drunk drivers on the highway—by relaying reports through base stations to the highway patrol. While this procedure had been going on for a long time, and hams were occasionally reporting drunk drivers, there was no organized effort toward making hams recognize that drunk drivers are a special problem that *can* be dealt with. I wanted to educate my club about drunk driving. Many members were unaware, for example, that every year 25,000 Americans die, and another 1.5 million are injured because of drunk drivers. On weekend nights, an average of one out of every ten vehicles on the road is driven by a legally drunk driver.

"A prepared amateur . . . can be of excellent service to the community if he or she does encounter a drunk driver."

I wanted to educate my club's members about how they, as hams, could help control the drunk-driving situation. Many amateurs don't know how to report a drunk driver, or they think it's much harder than it actually is, or they're in doubt when they see a hazardous driver. Perhaps they think it's not worth taking up a repeater to put in a call which most likely will be ignored anyway. I wanted to put these false suspicions to rest.

As it turns out, it's very easy to report a drunk driver. When in doubt, it *is* better to report the vehicle and have it checked out by the police. By not reporting it, you are allowing a possible highway catastrophe to happen. The highway patrol will take action if it receives a *well-defined, concrete, and legitimate report.* All it really takes is a ham with a hand-held or mobile radio to report a suspicious vehicle to a base station. The mobile operator then passes on to the base-station operator the suspicious vehicle's highway location, direction, approximate speed, make, color, year, and license-plate number (or as much of this information as is known). The base then passes this information to the local sheriff or highway patrol (whichever is appropriate for your area). A convincing way for a base-station operator to report an incident is to place the phone against the base radio speaker, so the officer hears the mobile operator report the incident firsthand. The base-station operator should then record all the information in his or her logbook or records.

Having spoken with the highway patrol office, I began speaking to other hams, giving them the facts and showing how it is possible

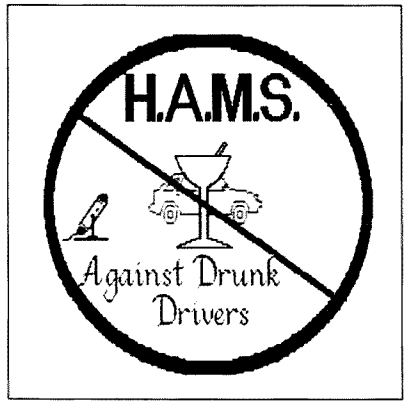


Fig. 1. The HAMS logo.

to help stop drunk drivers. I have also spread the word on the air, in our local Ham Radio Outlet, and in our San Fernando Valley Amateur Radio Club (W6SD) newsletter. Other club newsletters have printed my information about drunk drivers, as well. I also arranged for Officer Ken Rosenberg of the California Highway Patrol to speak to the San Fernando Valley ARC about the facts and procedures of reporting a drunk driver. The club members showed a willingness to support the program and are optimistic about their ability to make it work. I named the program the Highway Amateur Monitoring System, or HAMS as an acronym. Since then, there have been many incidents on the air in which hams have helped people on the road by making a report to the highway patrol.

The Highway Amateur Monitoring System is *not* intended to "scan the road for hazardous drivers." Rather, its function is to *prepare* an amateur to be able to deal with a road hazard if one should occur. Amateurs who have mobile gear must know how to perform an emergency communication, and they must know that the highway patrol is on their side and will respond to an emergency call. A trained amateur can report a disabled vehicle, an accident, a highway injury, or basically anything that poses a hazard to traffic or individuals on the highway. For example, on March 26, Ken Yaecker N6NHA called in on our local repeater and reported a stranded vehicle in the center divider lane of the freeway. The driver of the vehicle was too frightened to get out of the vehicle to call for help. But, because of Ken's radio call, a base station reported the information to the highway patrol, which then dispatched an officer to the site.

On another occasion, Hal Samuelson W6GXG drove by a vehicle that had pulled into the emergency lane. Inside, the driver lay back against the seat. While unsure about the condition of the driver, W6GXG reported the incident using his mobile radio. The highway patrol soon arrived and discovered that the driver of the vehicle had suffered a heart attack and was unconscious. Paramedics were then summoned to the site. This man could have died in his car had it not been for W6GXG's suspicion that something was wrong.

A prepared amateur can be of excellent service to the community if he or she does encounter a drunk driver. For example, at around 11:30 pm on Saturday, March 1, just five nights after Alex Vincent's death, a report came on our repeater about a recklessly driven tractor-trailer that was swerving and making S-maneuvers at about 70 miles per hour on the highway. The report came from an amateur with a mobile 2-meter radio who was traveling behind the tractor-trailer in the Gorman area, a dark, mountainous area north of Los Angeles. I answered his call and phoned the highway patrol, placing the phone against the speaker of my base radio so the officer heard the mobile ham directly relay the information about the vehicle. After the report was complete, a vehicle was dispatched. Twenty minutes later, the mobile ham reported that the highway patrol had stopped the still recklessly driven tractor-trailer and pulled it off the road. Had it not been for the ham-radio effort, the tractor-trailer could have killed somebody.



Alex Vincent—Victim of a drunk driver on February 24, 1986.

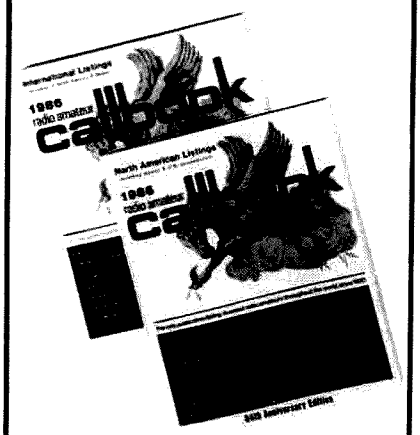
These incidents illustrate some of the ways in which the HAMS effort has been a success. Obviously, not every incident on the road will be witnessed by a ham, and nobody can force a ham to call in something he or she sees on the highway. But it is possible to educate the amateur community about drunk drivers and highway communications—as I have done in the San Fernando Valley.

The drunk driver suspected in Alex's death was brought under "suspicion of vehicular manslaughter." Witnesses who saw the drunk driver minutes *before* the crash took place were needed to testify as to how he was driving on the road. If a base-station operator logs the information received about a recklessly driven vehicle and if, a few minutes later, the vehicle causes a fatality or an injury, then the amateur operating the base station can use those records to provide evidence as to how the vehicle was being operated moments before the crash. It could help to get a conviction.

As I continue the HAMS effort, I strongly encourage all readers to do as I have done. Become involved and contact your local sheriff or highway patrol. Invite an official to talk to your radio club about the facts of drunk driving and how to report a drunk driver. Any time that a ham reports a drunk driver, he or she is potentially saving someone's life. We hams have a great capability to talk to each other with our hand-helds, mobile radios, and repeaters. Isn't it worth taking up three minutes of air time to use these capabilities to help prevent a possible catastrophe?

Drunk drivers cannot be completely eliminated. But, with your help, we can reduce the hazards on our highways and prevent tragic deaths—such as that of Alexandra Vincent, whose goal was "to do something special" for everyone she met. ■

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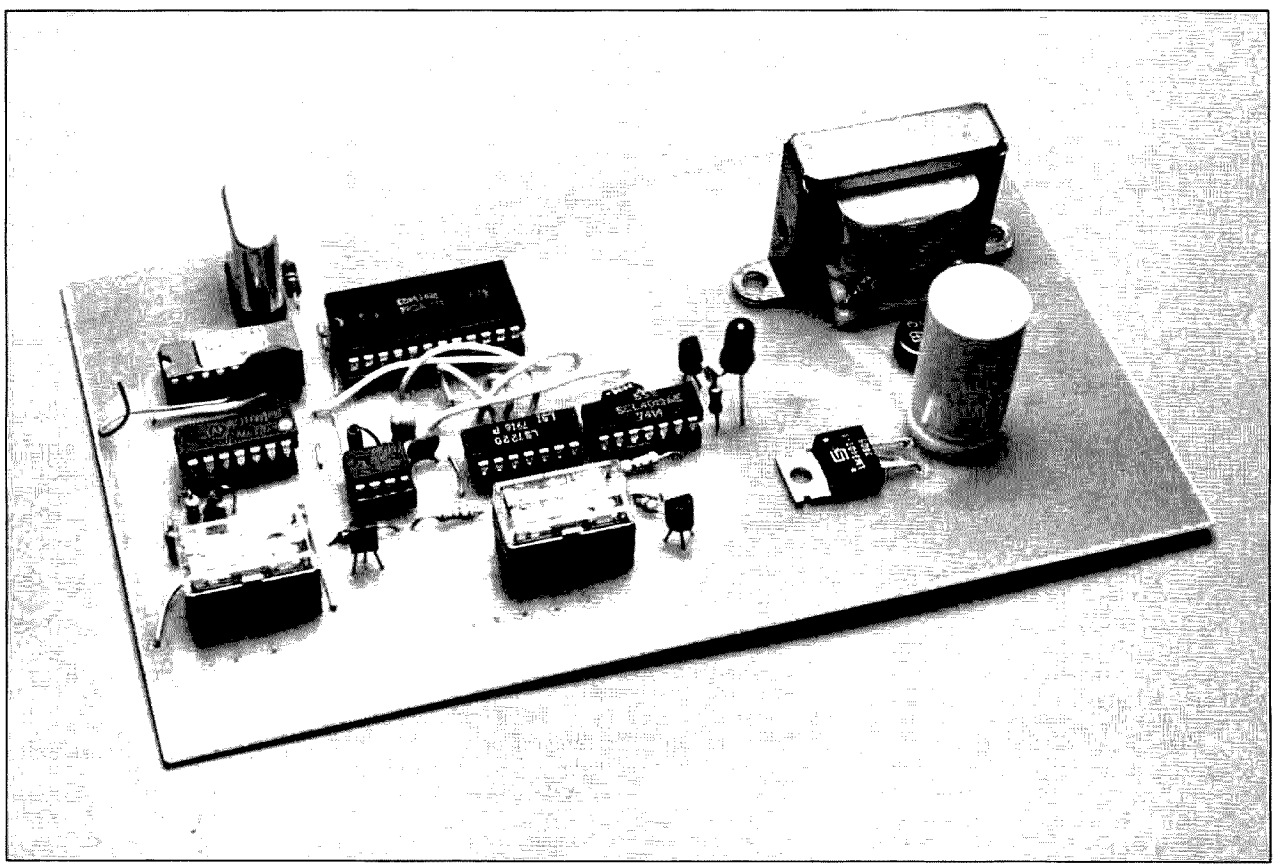
The Piggy-Bank Patch

Pete Putman completes the picture with an autopatch for his Piggy-Bank Repeater.

Many of the readers who contacted me after the publication of my simple repeater-control project ("Piggy-Bank Repeater Project," *73*, June, 1984) expressed interest in a companion autopatch controller, but at a budget price. The good news is that your wait is over!

This article describes a simple DTMF touchtone™ controller that uses inexpensive but reliable parts. Most parts can be obtained from the nearest Radio Shack store; the balance you can get from mail-order semiconductor houses. The circuit is relatively foolproof and offers secure, five-digit access and single-digit dump. Provisions have been made for muting the transmitted access tones, and the entire circuit interfaces with the Piggy Bank controller to provide dependable timeouts and disconnects, if needed.

The heart of the circuit is Silicon System's SSI 202 chip, which is a complete DTMF decoder with band-splitting filters built in. All you need to make it work are a 1-megohm resistor, a 0.01-uF input-coupling capacitor, and a standard colorburst crystal (3.579545 MHz)—all of which are easily obtained.



Your repeater's new autopatch: inexpensive, foolproof, reliable, and secure.

The SSI 202 runs from a supply voltage of 5 volts, and its output is either configured as 4-bit hexidecimal code, or binary 2 of 8. In this particular circuit, the hexidecimal code is used to drive a CD4514BE 4-to-16-line decoder, providing the necessary decoded digits. The SSI 202 has proven itself to be a reliable performer and exhibits excellent speech immunity. In fact, when the prototype was fabricated, I deliberately overdrove the input stage to see if the distorted audio products would create harmonics which would somehow "decode" as a valid digit. They did not!

Here's the interesting part: LSI Computer Systems of Melville, New York, has long offered a keyless-lock IC, type LS7220, to be used in automotive ignition lock systems. This chip is both inexpensive and flexible and lends itself well to a secure autopatch access system. In order to do its job, the LS7220 must detect five valid logic 1 signals in order at its inputs.

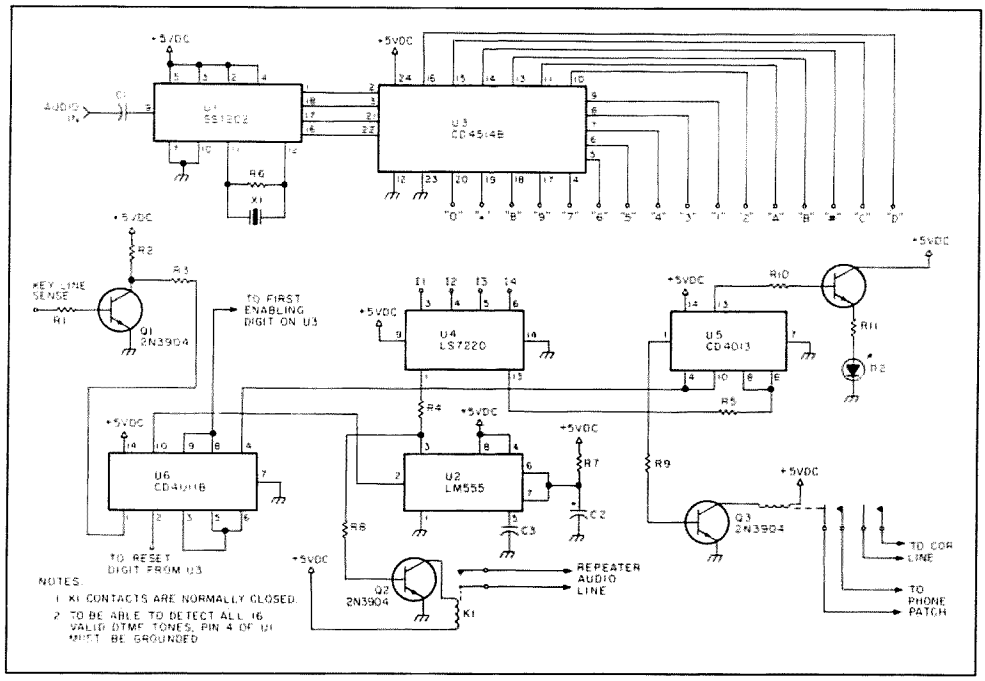


Fig. 1. Schematic diagram.

The first logic 1 is applied to SENSE INPUT to enable the chip to detect the remaining four signals. These are all momentary states and must be applied in the correct sequence. If any logic 1 signal is applied out of sequence, the entire chip resets to a zero state including all previously-detected valid inputs.

Example: Assume the access code is 51432. As you input 5, 1, and 4, you've set the SENSE INPUT and unlocked two of the four inputs in order. However, should you input anything other than a 3 for the next digit, the entire sequence must be repeated as all pins are reset to zero.

Once the correct sequence is accessed, the output pin, called LOCK CONTROL OUTPUT goes high and can be used to control a small relay. It also works well as a relay driver for high-current applications. This output will stay high as long as one of two things happens: (1) the SENSE INPUT is held high, or (2) a logic 1 is applied to the SAVE INPUT. For our purposes, we'll use option #1.

Refer to Fig. 1 for the schematic. Incoming line-level audio is fed through C1 to pin 9 of U1, SSI 202. R1 and X1 form the reference oscillator across pins 11 and 12. Valid digits are detected and appear as a hexidecimal code at pins 1, 18, 17, and 16. These in turn are connected to pins 2, 3, 21, and 22 of U3, a CD4514 4-to-16-line decoder. All 16 DTMF digits appear as a momentary logic 1 at pins 4–11 and 13–20 of U3, depending on the digit entered.

Let's say the first digit of the access code is 5. When a valid 5 is detected by U1, pin 6 of U3 goes high momentarily. This pin is inverted by U6C, a CD4011 quad NAND gate through pins 8 and 9 (which are tied together). Pin 10 goes low momentarily, which triggers U2, an LM555 one-shot. The output of U2 goes to two places: First, it drives Q2, a 2N3904 relay driver. This relay momentarily interrupts repeater audio and mutes the DTMF tones from being repeated over the air. The muting interval is also the window in which the remaining four digits must be correctly entered. This interval is set by R2 and C2 and is typically 1.5–2 seconds.

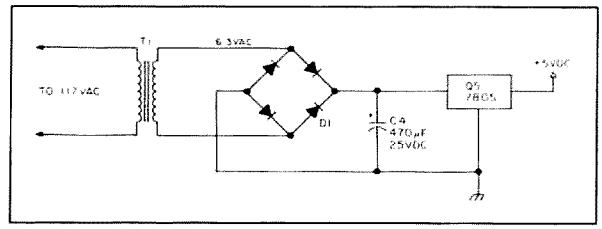


Fig. 2. Power supply for the autopatch.

The output of U2 is also sent to pin 1 of U4, an LS7220. This is the SENSE INPUT pin and must be tied high for the rest of the digits to be decoded. All of this takes microseconds to occur, so the dialing sequence can be fairly rapid—such as that initiated by an autodialing microphone.

Now that the tones are muted and the keyless-lock chip is enabled, the next four digits, 1432, sequentially decode the LS7220, and pin 13, LOCK CONTROL OUTPUT, will go high. The only problem is that once the window closes as U2 resets, the SENSE input will go low and U4 will reset.

Here's where U5A comes in. U5 is a dual D flip-flop. U5A actually controls the autopatch and COR LOCK relays—not U4. When U4 is set high at pin 13, this voltage goes to pin 6 of U5A. This is the SET line for the flip-flop. However, pin 4 must be tied low in order for the flip-flop to be set.

This is accomplished in a rather unique and clever manner! Q1, another 2N3904, senses the transmitter key line from the repeater controller. This line must go high on transmit. When someone keys up the repeater to dial up the patch, the transmit key line goes high and Q1 inverts this signal. It is then fed to pin 1 of U6A, another NAND gate. Pin 2 is normally low (we'll get back to that) so the output of the gate—pin 3—goes high. This signal is inverted again and debounced through U6B. The output of pin 4 is now low while the transmitter is keyed up and this goes to pin 4 of U5A, the RESET line! Follow me so far?

After the correct sequence has been dialed, the SET line (pin 6 of U5A) goes high and the Q output of U5A (pin 1) also goes high. This drives Q3, yet another 2N3904, which pulls in R2. This relay actually turns on the autopatch, but also it is connected to your repeater's COR line and either grounds it or ties it high, depending on what's needed to make the repeater stay keyed.

Now the input signal can be dropped since the autopatch will hold the repeater on, and while it is on the transmit key line keeps the autopatch operative. The two circuits actually hold each other up! While this is all happening the repeater timeout timer is running (one hopes) and will play an important role which will be covered in a moment.

Let's go back now to pin 2 of U6A. This pin

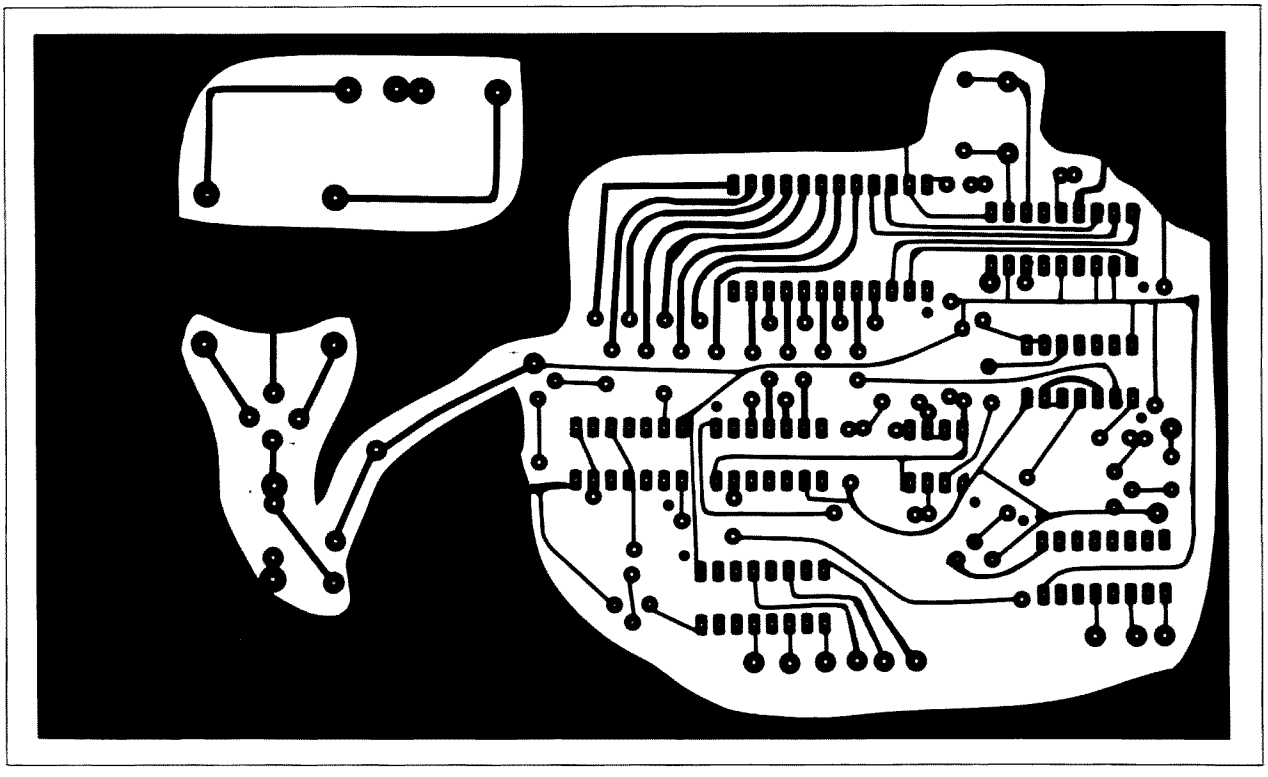


Fig. 3. Circuit board, foil side.

is normally low since it is connected to one of the pins on U3 not normally in use. We'll assume that pin is the # symbol. Should U1 detect a valid # (as it would when you decided to disconnect) and pass it along to U3, pin 14 of U3 would go high momentarily. This also would drive pin 2 of U6A high, thus causing pin 3 to go low. This would invert through U6B, which would then drive pin 4 of U5A high, thereby shutting off the autopatch and releasing the COR line. Clever, eh?

Now let's assume that in the middle of your call your batteries go dead. Horrors! You can't shut the patch off and there isn't a spare battery in sight. Not to worry, for the repeater timeout timer will run its course and shut the transmitter off. The minute this happens, the key line sensed through Q1 will go low. The signal is inverted, and this time pin 1 of U6A is tied low—not pin 2. The effect is the same, however. The RESET line of U5A will go high and *clunk*, off goes the autopatch. This is what makes the system foolproof—assuming the timeout timer works okay. If it doesn't, you'd be off the air anyhow as this is an FCC requirement for repeaters.

The other half of U5 is put to use to drive a small LED through Q4 to indicate that the system is up. Also, should you desire to inhibit the patch for any reason, put a switch with the key-line-sensing transistor, Q1, and your transmitter will keep pin 4 of U5A tied high when it is shut off. No matter what you do, you can't bring up the patch as long as pin 4 is tied high.

Incidentally, you can drive your COR line directly from pin 13 of U5B if you don't need the LED indicator. Pin 13 goes high when the patch is on, and can hold a COR open through a 10k resistor. For low-going COR circuits, use pin 12 of U5B through a 10k resistor.

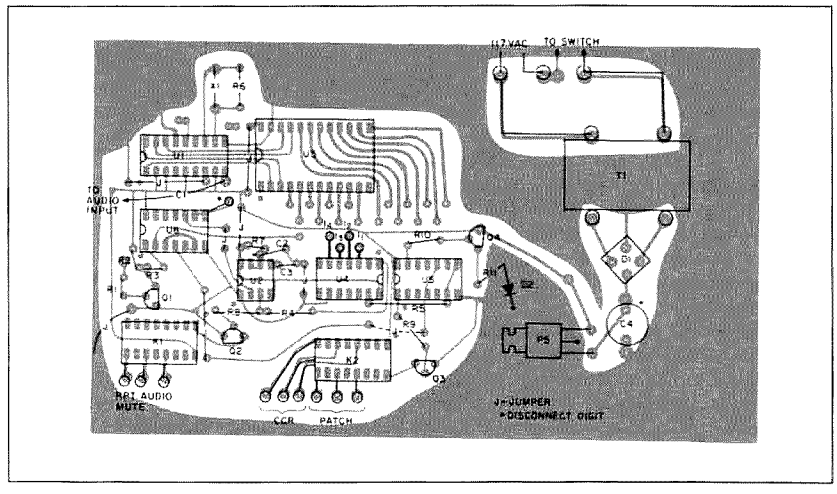


Fig. 4. Parts placement diagram.

The power supply is simple indeed (Fig. 2). T1 is a 6.3-V-ac, 300-mA transformer. Rectifier D1 is a full-wave bridge which feeds C4 and Q5, a 5-volt regulator. The entire board measures only 6-3/4" x 4" and fits in a standard enclosure. The photo shows the assembled unit. Fig. 3 is a full-size template for the PC board, and Fig. 4 shows parts placement.

The actual patch circuit is up to you. The old Heathkit™ makes an excellent choice, and there are other models floating around the market which will do the job nicely. You could even fabricate something yourself, if need be.

Here's the best part: All of the parts with the exception of U1, U3, and U4 can be bought right down at your local Radio Shack store. U1, the SSI 202, may be bought from Hallmark Electronics (See below for address).

U3, the CD4514, is available from Jameco Electronics, but since they require a minimum order of $20.00, you might wish to get most of the parts there as well. Otherwise, the

Sources for the SSI 202 chip:

Engineering Consulting*
583 Candlewood Street
Brea CA 92621

Hallmark Electronics**
107 Fairfield Road
Fairfield NJ 07006

*—This company advertised a complete kit for $22.95 for the SSI 201, the predecessor to the SSI 202. The chips are NOT compatible, but they may now be selling SSI 202 kits. It's worth an inquiry.

**—Hallmark does stock the SSI 202 and the cost per unit, as of this writing, in small quantities was $25.00 apiece. Write for ordering information.

Source for the LS7220 chip:

LSI Computer Systems, Inc.
1235 Walt Whitman Road
Melville NY 11747

Prices vary depending on quantity, but range from $3.50 to $3.00 apiece. Shipping extra.

Sources for the CD4514 chip:

Jameco Electronics
1355 Shoreway Road
Belmont CA 94002
Min. Order: $20.00

Digi-Key Corporation
PO Box 677
Thief River Falls MN 56701
Min. Order: None

chip can be purchased over the counter at most semiconductor houses.

U4, the LS7220, is available from the manufacturer, LSI Systems of Melville NY.

Now, with your Piggy-Bank controller and autopatch, all you need is an inexpensive repeater. Hmm!■

Parts List

Component	Description	Source	Price (each)
C1	0.01 uF, 50 volts	Radio Shack/Jameco/Digi-Key	.39
C2	4.7 uF, 25 volts*	Radio Shack/Jameco/Digi-Key	.49
C3	0.01 uF, 50 volts	Radio Shack/Jameco/Digi-Key	.39
C4	470 uF, 35 V dc	Radio Shack/Jameco/Digi-Key	.99
D1	1.5 A, 50 piv Full-wave bridge rectifier	Radio Shack/Jameco/Digi-Key	1.09
D2	2-V-dc, 20-mA LED	Radio Shack/Jameco/Digi-Key	.69
K1, K2	DIP DPDT relay, 5-V-dc coil contacts 125 V dc @1 A	Radio Shack #275-215	3.99
Q1–Q4	2N3904/2N2222 type	Radio Shack/Jameco/Digi-Key	.69
Q5	7805 5-volt regulator	Radio Shack/Jameco/Digi-Key	1.59
R1, R3, R4	10k Ohms, 1/4 Watt	Radio Shack/Jameco/Digi-Key	.39
R2, R5	47k Ohms, 1/4 Watt	Radio Shack/Jameco/Digi-Key	.39
R6	1 Megohm, 1/4 Watt	Radio Shack/Jameco/Digi-Key	.39
R7	470k Ohms, 1/4 Watt*	Radio Shack/Jameco/Digi-Key	.39
R8, R9, R10	2.2k Ohms, 1/4 Watt	Radio Shack/Jameco/Digi-Key	.39
R11	1.2k Ohms, 1/4 Watt	Radio Shack/Jameco/Digi-Key	.39
T1	117-V-ac Primary, 6.3-V-ac @ 300-mA Secondary	Radio Shack #273-1384**	2.59
U1	Silicon Systems SSI 202 DTMF Decoder	Hallmark Electronics	25.00
U2	TLC555 Timer	Radio Shack/Jameco/Digi-Key	1.19
U3	CD4514B 4-to-16-Line Decoder	Jameco/Digi-Key	3.49
U4	LS7220 Keyless-Lock IC	LSI Computer Systems	3.50
U5	CD4013 Dual-D Flip-Flop	Radio Shack/Jameco/Digi-Key	1.19
U6	CD4011 Quad NAND Gate	Radio Shack/Jameco/Digi-Key	.99
X1	Colorburst Crystal 3.579545 MHz	Radio Shack #272-1310	1.69

Notes:

All prices are taken from the 1985 Radio Shack catalog, except U1, U3, and U4.

*—These components determine the time constant for U2. They can vary to suit your needs. The designated components will provide a "window" of about 2 seconds.

**—The PC template was drilled to fit this particular transformer. It solders directly into the supplied holes. Cut off the solder tabs on top for safety.

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Future Hams of America

CMARC shared the excitement of ham radio with 8000 visitors to the Boston Museum of Science.

Bob Salow WA1IDA's dreams came true when the Council of Eastern Massachusetts Amateur Radio Clubs, CMARC, an ARRL organization, dominated Boston's Museum of Science on April 26–27 for an extraordinary exhibition of amateur radio. Salow, the primary driving force, had devised and nurtured the plan for over a year before its fruition.

Why a science museum? Jim Fisk W1HL, President of the Billerica (Massachusetts) Amateur Radio Society, felt "a demonstration would not attract people to come to a museum." He believes that the main thing that attracts people to a museum in the first place is their natural curiosity. And he thinks it is *this* group of people that would be inclined to get involved in ham radio.

The museum identifies itself as "a world of ideas," with exhibits of natural history, physical science, medicine, and astronomy, but according to Salow, the one thing it lacks is electronics—specifically communication.

CMARC, with the support of the ARRL, saw the project as an unprecedented opportunity to promote interclub involvement of its 45 clubs. Salow recalled a similar event in 1977: "It was well attended. There seemed to be a lot of interest. My thought was [that] there should be some continuation of it."

April 26th was gray and cloudy—a perfect day to go to a museum. The exhibit, consisting of nine large curtained areas, occupied more than a third of the museum's lower level. Museum staff greeted visitors, passed out literature pertaining to amateur radio, and directed people to the various ham displays. In only two days, close to 8,000 people learned what amateur radio is all about.

One of the most popular attractions was code practice. Young and old alike received a 5-minute lesson and certificate of completion. Saturday's code instructor, Wayne Bethoney KA1NSE, said, "Everybody smiles when they get it right. Sending their name is the first big step. Women are very interested in joining. Kids and adults—the interest is mixed."

With certificate in hand, the FHA—future ham of America—rounded the corner to the next stop—to send a *real* message or to visit OSCAR.

One of the volunteers, Dana Tremblay



Photo A. One week before the exhibit opens: antenna assembly on the roof of the Museum of Science.

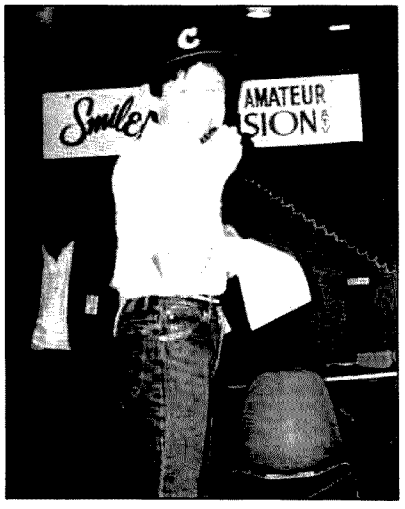


Photo B. "Look, Ma, I'm on TV."

WA1HUM, reported some technical difficulties: "It's probably one of the worst locations in the city you could have. The problem is interference." Part of the problem was overcome by ham ingenuity—a coffee-can configuration set up to act like a filter—and an AMSAT video showed what was supposed to be happening. Tremblay said, "People interested tend to be older, more sophisticated. The general reaction is 'Amateurs have a satellite up there?' They want to know how far away [it is], how much it costs, [and] how big it is—really."

Lines formed for the amateur TV display while giggling girls talked to a 15-year-old Wakefield, Massachusetts, ham. "Can he see us?" they asked. Bob Crowley, another CMARC volunteer, observed that both children and adults were fascinated by the video aspect of ham radio. "They want to know how to hook up the VCR they bought for Christmas. For kids who have been spoon-fed TV, it has immediacy." Other questions from the crowd, such as "Can you turn the channel and get someone else?" or "Who's filming this?" brought smiles to any ham within earshot.

Virginia Williams KA1KKS, who manned the message center, said, "They think it's fun to see the message sent. Mostly, they say, 'Ooooh, how can they do that?' We've had more messages from children than anyone else."

Packet radio, headed by Ron Reder KA1KCU, was another crowd pleaser. "Most people seem to enjoy it," he remarked. "They're very interested." But interest isn't always enough. "You have to go out and greet people," he continued. "Bring them into the booth. The approach has a lot to do with it, like [it did] to a second grader—her mom had to help her type."

The two-way HF communication setup brought in countries like Scotland and the Ukraine. Visitors were able to check various maps to see how far the signal was traveling. Gary Skuse KA1NJL, an enthusiastic worker, noted, "Little kids are awestruck. They think it's fantastic. They ask, 'Who are you talking to? How far out can you talk?' People seem very interested and want to get involved. It seems to be that children are more interested."

Pat Couture N1CKN directed the information station and was assisted by Libby Karpeij KA1DTU of the ARRL. Karpeij reflected on her involvement with the event: "I asked if I could observe. The whole thing was completely underway. I don't think it's been done on such a large scale. The more clubs that could do it, the better. But unless you have simply an enormous club, it's really not practical." According to Couture, the event was particularly significant because "this is the first time ham radio has gone into the public and interfaced on a large scale. Everybody is looking at this."

The ham spirit prevailed, as one Girl Scout leader commented, "I've never seen an exhibit as warm and friendly as this. People went out of their way to talk to [the girls] and draw people into the exhibits."



Photo C. A code class led by KA1NSE.

At the message center, Tom Kinahan N1CPE, a team leader, explained that "traffic originating at the museum was sent to remote station K1KTZ in Wellesley, Massachusetts, via packet links. At this station, all incoming messages were dumped to a printer and from here, they were routed via 2 meters, HF nets, and informal liasons to other destinations. All traffic was originated under the call KA1SM."

After it was over, museum staffer Phyllis Dohanian said, "It has worked out pretty well. The director would like to see something like this every weekend. I don't think it's a child's activity; you need motor skills and a level of intelligence. I tried to get Bob to focus on how things work—a key into science, to teach about any kind of radio transmission."

Salow's dream was to target the exhibition toward a preselected audience: "The objective, long term, is to get a permanent exhibit at the museum. I realize you can't put one in [with] *magic*. You have to get a degree of credibility, raise money, get equipment, and stock it."

No one knows exactly when the idea started, but fund raising for this event began long ago with the sale of a map showing 2-meter repeater locations in New England. The map was prepared with great care by Lew Nyman K1AZE. "The map sold very well," Salow said. "We sold ads to defray the cost. We printed it up and sold it for $2 at flea markets, hamfests, everywhere. The money enabled us to move on this."

The next step was to approach the museum. Salow tried to "find people with influence in the museum like Bradford Washburn, world famous and former director. We got names of people at the museum a year ago and waited. Nothing happened. We called them. It was very difficult to get in touch with them."

Phyllis Dohanian of the museum's Service League mentioned some obstacles CMARC encountered that any group would encounter in an undertaking of this nature: "[CMARC] wrote the former director. [The museum bureaucracy] had mixed feelings. [They thought it would be] an activity where people participating [would have] fun, but [wouldn't] interact with museum visitors."

But Salow persisted. His ambition and perseverance finally succeeded: "Last October we made contact."

Another problem surfaced. Dohanian explained: "We have a very busy schedule. The museum couldn't give me the time and personnel to do it. We are run nonprofit and have to do things the cheapest way. People don't get paid the same way."

Guidelines were established for the proj-

Dennis Shapiro W1UF—HF Station
Dave Craig WB1CEA—ATV
Dana Tremblay WA1HUM—Space Satellite
Ron Reder KA1KCU—Packet
Tom Kinahan N1CPE—Message Center
Ed LaJoie K1CB—CW Center
Pat Couture N1CKN—General Information
Bob Gibbons W1REP—Public Service—Emergency
Bob Salow WA1IDA—Coordinator

Fig. 1. Team leaders.

ARRL literature
Cushcraft catalog
Internal checklists
Radiogram for visitors
List of Morse-code characters
Participation certificate
CMARC directory
CMARC literature
Press packet

Fig. 2. Literature given to participants.



Photo D. "CQ DX, CQ DX."



Photo E. Some of the CMARC volunteer staff.

ect. "We looked at it again," Dohanian said. "We wanted it [to be] scientific, educational, [and] interactive with museum visitors. We got together, mostly Bob and me, and talked about quite a number of logistics, dealing with the physical plant, electronic equipment interacting with electronic equipment at the museum."

Next, Salow "sketched out the budget and all kinds of other things. It did not move quickly. In February, we got the answer—OK. We had to set a date, but they couldn't give us a confirmation. It was March before we knew what was going to happen. We got a date in April."

Dohanian praised Salow: "He had the best way, a number of group leaders. When they needed something, he and the group leader would meet with the appropriate person."

Salow recruited and recruited and recruited, because "no one club could put together an exhibit without the knowledgeable people. Most clubs are general-purpose clubs." A great many hams were at the Dayton Hamvention, and so were unable to lend a hand.

So now they had the museum. They had the people. But what about equipment?

Steve Gilbert WA1AYS, a CMARC volunteer, is a walking success story. "I contacted Dave K1WHS on 2 meters. He owns the Main Monster, a 2-meter moonbounce station, one of the biggest stations in the world. He passed the word to his boss, Glen White of Cushcraft. My question was to borrow an antenna. He asked, 'What else do you need?' "

Gilbert's fancy footwork procured loans from Carol Cable of Pawtucket, Rhode Island, for 1,000 feet of 9913-equivalent, and another 1,000 feet of actual Belden 9913 from Belden Cooper Industries. Gilbert added, "The companies were tremendously helpful. You have to give them credit for more than giving us the stuff, but for the vision."

The challenge of erecting antennas was met with great vigor. Each of the nine antennas for the exhibit required 150–180 feet of feedline. Originating on the roof, the feedline was fed down through three floors, in and out of doors and windows to the basement. The real challenge was getting a 6-foot ham with a 5-foot tower through the boiler room, around a corner not much wider than his shoulder, and up two flights of stairs. Antenna sections were passed along like a bucket brigade and handed up to the man at the top of the stairs. Prior to the exhibit two consecutive weekends were needed to assemble, transport, and erect the metal monsters that would loom over the museum.

On May 24, 1844, Samuel Morse transmitted the first message on U.S. telegraph. 142 years later, a short distance from his birthplace, hams of the future watched messages on television, printers, and screens. The exhibit succeeded in bridging a gap between today's youths and the world of amateur radio. It proved beyond a doubt that almost 300 CMARC hams are anything but amateur. Salow commented once that "when you deal with me, you deal with perfection," and anyone who visited the museum that weekend would say that he was absolutely right. ■

Inside Tips

1. If you plan to have an exhibit, first write the museum director, head of exhibits, or someone in charge of special programs at a science museum, industrial museum, or any adult museum.
2. Arrange a meeting to discuss the possibility of an exhibit. Determine if the museum is willing to sponsor or co-sponsor it.
3. Allow a minimum of six months lead time, but a year is better.
4. Pray for rain. Perfect weather means low attendance.

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_____ 26 27 April '86.
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Fig. 3. Certificate of participation.

CLUBS

Marc Stern N1BLH
c/o 73

Publish or Perish

Does a great club mean a great newsletter, or is it the other way around? N1BLH, a man with ink in his veins, helps you resuscitate your rag.

One of the most important offices in any club is that of newsletter or bulletin editor. That task provides the glue that binds a club together during the month. Like completing a circuit, a club's monthly newsletter provides a path through which the news and notices flow.

Newsletters typically range from professionally typeset, printed, and bound publications to one-page sheets that are hastily run off at the corner copy shop. Unfortunately, there are far too many of the latter across the spectrum of radio clubs and far too few of the former.

Usually, the more professionally done newsletters are found in clubs that not only have an active membership, but that are also exciting. These clubs have a dynamism and energy that spreads from the youngest member to the oldest operator. Quite likely, these clubs also have active class programs that encourage new operators to enter the hobby, as well as active social, educational, and operating calendars to keep everyone interested.

This isn't to say those clubs with one- or two-page newsletters may not be equally active and exciting. What they probably lack is the funding to handle the printing, which can easily run over $1,000 per year for a 100-member club with 11 or 12 newsletters.



Fig. 1. Past Newsletter of the Month winners.

Still, it's unlikely that clubs that hastily print one-page, poorly typeset and reproduced newsletters are very active. Quite likely, the president not only heads the club but also writes the newsletter; takes the minutes; handles correspondence; finds speakers, films, or activities; as well as types up the mailing labels and licks the stamps. It's a one-man show that has fallen on his shoulders by default. All it takes is one volunteer, the editor, to begin changing this picture, and the newsletter is off the ground.

However, while volunteers can make a great deal of difference, another key ingredient to a successful newsletter is the willingness to fund the cost of production. Unless someone in your club owns a print shop or knows someone who does—an ideal situation—the chances are good that you'll find you have a monthly cash outlay, which a club can't be afraid to make. Since the newsletter is the most visible part of the club to many hams and community leaders—if they are included on the mailing list, which they should be because it's just good public relations—and since it is also the primary news medium for members and potential members of the club, it pays to do the best job your club can afford.

If, for example, you can afford professional printing but not photo work, then don't use photos. Retain the professional printing, however; it lends a finished look to the publication.

The most important ingredient after the editor and funding is support. Since the newsletter is the club's mouthpiece—not the editor's private soapbox or the executive board's private opinion sheet—the editor

must encourage club input. In many cases this is like pulling teeth from the proverbial chicken, but it still has to be done.

For example, in the club where I am newsletter editor—the Framingham (Massachusetts) Amateur Radio Association—I have encouraged members to submit whatever they want to submit, and I've had a fair degree of success. Recently, a couple of our women members asked if they could have some recipes published and I said, "Why not?" Yes, it did raise hackles, but it shows the type of latitude we try to allow in the newsletter.

At other times, I've had people come forward with long lists of DX operations and beacons and we've published those, too. In fact, there have been some months where I've had so much material, I've had to hold some until the next month.

I just wish that were the case all the time, but like most editors I've found that it isn't. Much of the time, I'll write just about everything in the newsletter except the minutes of last month's meeting, repeater notes, and a listing of local flea markets, exams, and special events. These are provided for me.

". . . the bottom line is knowing a job is done correctly and to the best of your ability."

And this brings us to another consideration: format. Before the final printing, it's a good idea to experiment with format on a dummy issue. If many of your club members are older operators, then it makes sense to use larger type so that it's easier for them to read. Likewise, it also makes sense to print text in page format rather than in columnar format, which can be somewhat harder for older operators to read.

On the other hand, if most of your members are on the younger side, then experiment. Try various type sizes and styles to give your newsletter a unique flavor.

For example, the newsletter of the Nashua (New Hampshire) Area Radio Club, which I see as part of our newsletter exchange, has a professional appearance. Not only is it printed in two-column format, but the type style is clean and readable. Also, the club includes photos, which gives its newsletter a professional feel. Besides, it's apparent from the photos that the membership is active and supports not only its club, but also its newsletter.

Another unique newsletter I have seen is that of the Wellesley (Massachusetts) Amateur Radio Society. WARS makes effective use of two-column format and graphic and shaded headlines to create a very pleasant newsletter. The writing is light and the typesetting good, setting this newsletter apart.

Looking at the other side of the coin, I have seen newsletters that are little more than mimeographed or photocopied one-page throwaways that do little more than announce the meeting and the meeting site. They aren't too informative and look so amateurish that you have to wonder about the quality of the club. The print quality is also usually poor because a wide-matrix dot-matrix computer printer has been used, making everything look shoddily prepared.

With the editor found, funding and support assured, and format determined, there's little more for the editor to do except put the newsletter together, right? The answer, unfortunately, is wrong because there's still more to do, as WA1UEH, our newsletter's former editor for seven years, can attest.

Even though we have seen it is possible to establish a moderately continuous flow of material, it requires an editor's vigilance to ensure that this material will keep on flowing. For the most part, a simple phone call gets it in on time.

This information-gathering process has been greatly enhanced by the arrival of the personal computer in the ham shack. Although I use mine for business purposes, I also use it in the hobby, as well as for correspondence. The same is true of other club members, several of whom also contribute material to the newsletter. We can do this because our machines are equipped with modems, which makes it easy for them to zip information to me. All they have to do is dial my home phone; the computer answers, and the information is transferred.

In this manner, we can update the newsletter until the last minute before it is transferred to the club president's—KB1EW—machine. He prints it out and has it printed for us. As

FILL 'ER UP

OK, so you've decided to really improve the old newsletter, and now comes the question of exactly what it is you're going to fill those brilliantly designed, professionally produced pages with. Somewhere in this world, there must be someone who enjoys reading the minutes of last month's meeting. We at *73* have never met the man.

People

As much as we like to talk about rigs, antennas, and the weather, the most interesting subject in ham radio is *people*. "Fred made a new antenna out of his old Nash Rambler. Bob tried to put up a dipole with a bow and arrow, hit a sea gull, and hasn't seen the antenna since. Crazy Larry fell off his tower again—he's got an HT in the hospital with him and he'd love to hear from you." The one thing people never get tired of reading about is themselves.

Activities

Your newsletter is your chance to light a fire under your club. An "active" club isn't one that just has regular meetings. Activate your club by selling the members on a pilgrimage to Dayton, or a barbeque in your backyard, or something. A newsletter that deals strictly in reporting what has happened in the past will be *boring*. Inject the future into your publication. "Field Day is going to be bigger than ever this year, that is, if you folks will just get going. We've had 27 people volunteer to help dispense the beer, but we could really use some help getting a Novice station set up." Production schedules and delays do have a way of turning your "future" writings into the history by the time the newsletter comes out, but at least you'll be closer than you were before.

Plagiarism

We at *73* do not care which of the other three ham magazines you plagiarize. But seriously, folks, if you see something in *73* that would be of use in your newsletter, write us a letter and tell us what you want to do. Chances are, unless you're trying to make a buck off the deal, we'll give you the OK. N1BLH tells you exactly where to look for the rest of your news—there's always lots of material; you just have to know where to look.

Art

Someone in your club has enough artistic skill to draw up a clever logo. Find him or her. It's true that you can't tell a book by its cover, but it's also true that your great information will be ignored if it looks ugly. Illustrations and cartoons break up the text and make for easier reading. Somebody in your club must think that he's funny enough to do a monthly cartoon. Give him a chance.

First Class

It takes only slightly more effort to put out a first-class publication than it does to put out a boring rag. The editor who has had the job dumped on him and who is given no help in the endeavor is unlikely to make the extra effort—he's also unlikely to be editor for very long. With a little help from *you*, your club's newsletter will be something people look forward to receiving each month. Without your help: "The June meeting was opened and the minutes of the May meeting were approved. Don Dirge brought up the subject of whether or not to move the club repeater, which is currently not working anyway because Bill Bore forgot to. . . ."

NEWSLETTER OF THE MONTH

Every month, *73*'s editorial staff sifts through the hundreds of newsletters that we receive, searching for one that stands out from the crowd. If you'd like to enter your club's publication in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn. Newsletter of the Month.

you can see, there's very little paper that changes hands today, other than in the initial information-input process.

Even with this automation, there are months in which all the persuasion and reminding in the world doesn't produce much copy. In those months you must turn to your alternate sources of information—other club bulletins, ham radio newsletters, and organizations such as the Amateur Radio News Service.

From other club bulletins, you can usually extract local information about which club is doing what and where local classes and flea markets are being planned or held. Generally, you'll find that between your own input and local bulletins, you may be able to fill half the newsletter.

Your next source of information, then, comes from newsletters such as the *W5YI Report* and *ARRL Letter*. They provide up-to-date information on matters of crucial interest. In fact, many of the newsletters I see make liberal use of the information contained in these and other professionally produced newsletters. The only proviso in using this information is crediting the newsletter that originally contained it.

Likewise, the Amateur Radio News Service is an important source of input from across the country. Made up by several hundred bulletin editors, the *ARNS Bulletin* provides you with lighthearted material and cartoon fillers, as well as some serious editorials. You can use this information, provided you credit ARNS. ARNS is a separate group whose dues are $5 a year, but it's money well spent as I have found.

Finally, if you can do it—and if your budget allows it—try to use as many photos as you can. Not only does this create interest in the newsletter, but it also creates excitement in the club, which, after all, is the bottom line of any newsletter effort.

With all of this done, the mundane work is next: folding, labeling, and stamping. If you have several people on your committee, this can go quite quickly. However, most of the time you'll find that you're doing this yourself. Relax, though; it doesn't take too much time and, if the labels are computer generated, it will be little effort to label, stamp, and mail them. In fact, if no one in your club can generate computerized mailing labels, it might be a good idea for your club to invest in having several sets of labels printed. In the long run, it will save time and effort.

When all is said and done, though, the bottom line in the newsletter is satisfaction—the satisfaction that comes with knowing a job is done correctly and to the best of your ability. Don't think that as editor you'll find people rushing up to you month after month to pat you on the back for the fine job you're doing—because they won't. To the long-suffering editor, those comments seem few and far between. But don't think the club doesn't appreciate the job you are doing, either—because it does. It's just that when a newsletter is running well and arrives on time every month, people take it for granted.

In a way, though, having people take the newsletter and its quality for granted is the ultimate compliment. It means they're satisfied with the work you are doing and with the newsletter as a whole. In fact, this type of quiet is reassuring because, as editor, you soon realize that if you blow something, you'll hear about it loud and long. Now, isn't the quiet better? You bet it is, and it means your newsletter's a hit.

So, if you have the right formula, you've got it made. Your newsletter may never win national awards, but it serves its purpose and informs. What more can you ask?■

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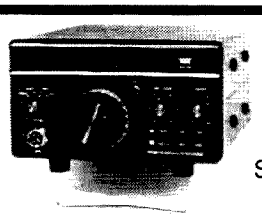
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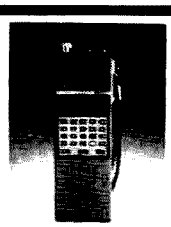

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the HAM STATION

Richard Phenix
73 Staff

Genius Brings Home The Bacon

. . . and hogs the spotlight.

It has been nearly seven years now since the truncated success of my home-brew Mobius-twist, All-purpose, Synergistic, Lumped-constant circuit, Hanger-hung, Folded dipole, Phase-velocity, Transcalent-transceive System (MASLHFPTS™)—the Mark 1 version of which, you may remember, blew up Con Edison generators in New York City in 1965, extinguishing lights all along the East Coast. (That's what truncated the success, of course—for the first truncation, that is. Since I hadn't remembered to fuse the rig, it blew up, too.)

No, I will NOT apologize again! Hoo, boy! Some soreheads never forget the smallest inconveniences! And if Missouri hadn't run out of mules. . . well, that's what brought about the final truncation: not enough mules. Only a couple more years of mule-kicking of components into random configurations (see Fig. 1) and the single-sided-band MASLHFPTS™ circuit, whatever it was, could have been reconstructed. Then, not only would those power-outage complaints have been drowned out by roars of public acclaim for the new rig, but I'd have been a multimillionaire.

Anyway, it's been so many years that it is time once again to stimulate readers of *73* with news of another promising field for basic research, experimentation, and home-brewing. This time mules will not be required. The main reason I called for them before was to help out a friend of mine who ran a mule farm near Neosho, Missouri; he needed the new business. HE was the one who became a millionaire. He moved to Norway. "I'd always wanted to live in Norway," he wrote me, "but until your hundreds of hams bought all my mules, I couldn't afjord to." (He never could spell.)

As so often is the case with pure researchers—I mean, when one is engaged in pure research—I discovered this new field serendipitously as a by-product of my continuing efforts to discover how my Mobius-twist antenna and the Adjustment Circuit Box had brought in signals from Mars *in color* when the basic module of my rig was an old black & white TV set. (See "Einstein Was Wrong" in the October, 1979, issue of *73* if you want to see how all this got started.) I had used up my last mule and was reduced to doing my own kicking; I was just about to quit (my foot was really sore) when I was overwhelmed by that same courageous determination which in my teens had made it possible for me to locate WOR, WJZ, and so on, on the family wireless nearly every time I tried! I just had to make one more effort!

". . . I had a date with a gorgeous broad in Boston in a few days, a zoftig, blue-eyed blonde . . ."

I did so, waited for the solder to cool, plugged the new circuit into the Adjustment Circuit Box, and disappeared.

The Mark 1 PIGS

When I say I disappeared, I mean that that's the way it would have looked to you if you had been there watching me—I'm not suggesting any of that weirdo science fiction stuff that nobody but a congenital idiot would believe. I was still visible, for heaven's sake, I could still see myself perfectly well; all that had happened was that I wasn't in my QTH anymore! I was out in my antenna field, under a 70-foot tower that hadn't been there an hour before. An hour before I had seen it where the truck had delivered it, lying flat on the floor of my barn, in sections, ready for a tower-raising party scheduled for the next day!

It didn't take long for me to think this thing through and realize that something strange had happened. I mean, I have had lots of experiences and I know a strange experience when I see one. And I did what I had learned to do: I stood perfectly still and pondered the matter. Not necessarily in this order, these were my conclusions:

1) The strangeness was of a different order from those which hams all over the world had reported to me, resulting from their own mule-kick efforts to reconstruct the MASLHFPTS™. There was the XT in Africa who turned light blue all over (he became a very successful witch doctor; I get all my potions from him, now); there was the 4K1 who used his strange result to heat his QTH, but he couldn't turn it off, and his last transmission came from a depth of approximately 7,000 feet under the ice cap; and, of course, there was the VO1 whose circuit sent out a subsonic whistle. I'm not sure I believe him, but he was there and I wasn't. If he says that this whistle, being slower than sound, piled up around him like transparent whipped cream snaking out of a pressurized can, and that it pierced both eardrums before he realized what had happened and kicked the rig into silence, well, maybe. . . .

2) It wasn't a one-dimensioned strangeness as in those examples. In this case, both time and space seemed to have been involved, even if only modestly. The distance from my QTH to the now-erected tower wasn't much over 100 feet, and the loose, moist dirt near the tower guy anchors obviously was only hours old.

3) I couldn't stand there forever.

4) Maybe my MASLHFPTS™ was going to be an oxymoron! That is, maybe I was about to turn a failure into a successful failure of some kind. Could I have discovered (invented) a time machine?

Well, hoo, boy! It sure looked it!

All of that happened last summer. During the winter of 1985/86, I did all the tedious analysis the situation called for—disconnecting and reconnecting components, substituting different values of components, rearrang-

ing components, etc. I found early on that values had nothing to do with results. The 1000-Ohm trimpot did (or didn't do) exactly as much as a 1-Ohm job; 330 uF/30 V meant as much (or as little) to the whole circuit as 3 pF/30 mV. Even substituting a 2N2222 for an MPF102 produced only minor variations. What seemed to be the determining factor was the relative positioning of the 15 components which had hit the perfboard when I kicked the table (and, of course, which had encountered hot solder while in flight and had thus formed into a circuit).

This was fortunate indeed—a great time-saver! It takes only 12,440 millenia to try out all the permutations for 15 variables (testing one every five minutes).

Ah, you spotted something contradictory there right away, didn't you! Can't fool a ham! So you probably have figured out how I coped with the dilemma. Yup. I calibrated my time/space machine along the time continuum first, and as soon as that was under control, I merely went back to the year 12,438,015 B.C., planning to work right through to 1986 A.D.

There were some problems! Not with aging—my metabolism stayed in neutral all the time I was in either the past or the future—but it was pure luck that I survived that trip back to what I figured out later was the Miocene Age. No sooner did I ever settle down to work when some lousy volcano would errupt and I'd have to flee. Between volcanoes there were earthquakes, and all the time those pesky ramapithecines and sivapithecines (early orangutans) kibitzed around with me. Let me tell you, this planet was no place to be in the old days!

So, I simply sliced up the time span into 59,238 segments and visited 1776 America 59,238 times for 210 years at a crack. It was fascinating to watch the shaping up of the United States, and hoo, boy! are our history books full of lies! Abe Lincoln, for example...but that's another story. Anyway, that's how I completed the analysis job.

Oh, yes. The name of my time machine. You know about IGSs (inertial guidance systems); all the best submarines have them, for example. An IGS tells the man steering his submarine where he is. Well, it struck me (literally, as I'll explain below) that a POSITIVE inertial guidance system (PIGS) would be one which didn't just lay there, it DID something, so my pet name for the machine became Pigasus (you know, the flying hog). The full name under which I'll register the trademark is the scientific one, of course: Positive Inertial Guidance System In Synergistic Plasmoidal Advectionated Cosmic Energy (PIGSinSPACE). (There is a luminous glow around the machine when in transit.)

The name came from literally being struck since it was in my mind when I recovered consciousness following one of the earliest attempts to calibrate the machine along the space continuum. It seems that there is an interaction between the two dimensions: The time setting has to be adjusted in the context of the setting for the space to be traversed. The shorter the distance the more the time setting has to be reduced to compensate for some sort of warp.

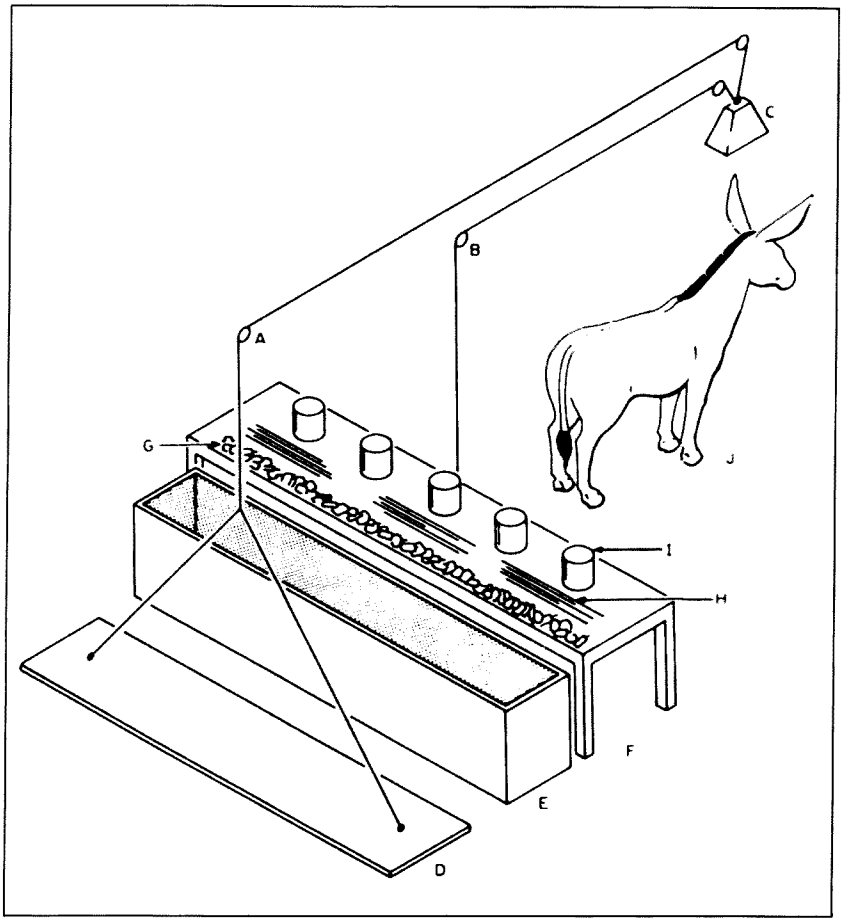


Fig. 1. Setup which might reproduce the original MASLHFPTS™. A—pulley system to jerk up cover (D) of Adjustment Circuit Box (E) when B, pulley system to weight (C) drops weight when mule (J) kicks over table (F) sending flying G—all components from your junk box, H—copper wires of assorted lengths, and I—pots of molten solder, into the perfboard-lined box and onto the cover as it flies up and over. Note: Weight C should be positioned to hit mule J on head to keep him calm until ready for the next setup. (Editor's Note: It has been estimated that 1000 of the world's most intelligent monkeys, working 16 hours a day at randomly "soldering" junk-box components together in order to duplicate either a MASLHFPTS™ or a PIGS, would make one heck of a mess and would smell like the stockyards of Chicago at the turn of the century.)

I had set the space control to take me to the office of a friend of mine in downtown Peterborough, and I set the time control for seven days in the past (when I knew he had been out of town—I wasn't ready to show him my machine). Well, his office is on the second floor of a building put up three years ago, and I arrived there four years ago and had one helluva fall through the branches of a pine tree, which knocked me silly. See what I mean?

Your Job, Should You Accept This Mission...

For reasons I'll share with you in a moment, I'm offering all of you readers who qualify a piece of the action (see box). It would be totally irresponsible either to market Pigasus in its present form (my Mark 1937945H model) or sell seats on it for trips to anytime. Not only should there be considerably more testing, but there are safety devices which need perfecting to avoid damage to riders at various stages. Cases in point:

1) An antigrav module to be plugged in whenever there is a likelihood that you could arrive in midair somewhen.

2) Drift prevention for the time and space settings. It is both physically and mentally painful to find yourself occupying two spaces at the same time even when they are only molecules apart—or worse, also at two points in time, even when separated only by nanoseconds. The sensation resembles that of being stretched on a Middle Ages torture rack between two high-fidelity speakers at full gain, both belting out "You're Nothin' But A Hound Dog," with one speaker equipped with a split-second time-delay circuit.

3) A governor is needed to prevent pur-

REQUIRED QUALIFICATIONS FOR DIRECTORS OF SWINE

1) Must be a citizen of at least two DXCC countries.
2) Must hold an Advanced ticket or equivalent.
3) Must be able to send 50 wpm in native language and 10 wpm in any ten other languages, at least one from each continent. (Drum proficiency may be substituted for an African language, smoke signaling for a North American language).
4) Must be able to modify an ICOM IC-27A to be an ICOM IC-751A using only parts from an ICOM IC-02AT, blindfolded, in a high wind, at 0 degrees C, wearing only mittens and sneakers.
5) Must have an IQ below 75 or above 150. Individuals on those levels have much the same mental characteristics. (Actually, this qualification may be assumed to be possessed by any ham who applies for a directorship.)

chasers (or renters) from visiting the future, unless they are cleared to do so by the appropriate federal agencies (FBI, CIA, FCC, FDA, NRA, LSD, etc.) and religious institutions (Council of Churches, the Vatican, and their Judaic, Moslem, Hindu, Buddhist, Druid, and etc. counterparts).

It is this last point that is of significance now: I am offering you a place on the Board of Directors of the Foundation for Synchronizing Waveforms In New Energies (SWINE), a nonprofit organization to oversee use of Pigasus, because I won't be around much longer to handle that task personally. You see, I visited the future once too often myself.

Mind you, I didn't mean to; I'm too smart for that. It was simply another case of learning by experimenting, and as we all know, sometimes we learn things that do us no good at all. Like those two innocents and the apple.

In my case, I had a date with a gorgeous broad in Boston in a few days, a zoftig, blue-eyed blonde, and the more I thought about it the more I just couldn't wait to find out if she and I had a future together, so I set my time and space controls for August of 1989 at her pad, threw the KPDT switch, felt the typical sleepy sensation, smelled the usual attar of roses (some sort of overheating of the special polytetrafluoroethylene insulation I developed, I think), and ttwweeeeeYUP, there I was in her living room and there she was: lying face down on her sofa, one arm under her head, the other draped over the edge, her hand gripping a newspaper. She was weeping. Great sobs were alternated with deep gulps of air....

Clearly there had been something in the paper—and I tiptoed over, craned my neck, and was able to read black headlines: a three-column spread on the right-hand side, and a subhead:

N.H. MAN DIES HEROICALLY

SAVING CHILD IN CHARLES RIVER

President Dianne Ritson

Establishes Federal Holiday

in Memory of Richard Phenix

I Pigasused back to Peterborough. I dunno. Maybe I should have checked the date on the paper...maybe I had been clumsy making the time setting...maybe it had been 1999 or something. I mean, Dianne is still Art Director for *73*, and so far nobody has even guessed that she has political ambitions....

Well, I found out that my zoftig, blue-eyed blonde and I did have *something* of a future (another damn oxymoron: another truncation: a futureless future). I mean, I was being cried over, wasn't I? Something must have transpired that she thought she was going to miss...unless my money.... No. Couldn't be that. I have only a couple of million in the bank.

Anyway, that's why NOW is the time for all you hams out there to apply for seats on the Board of Directors. ■

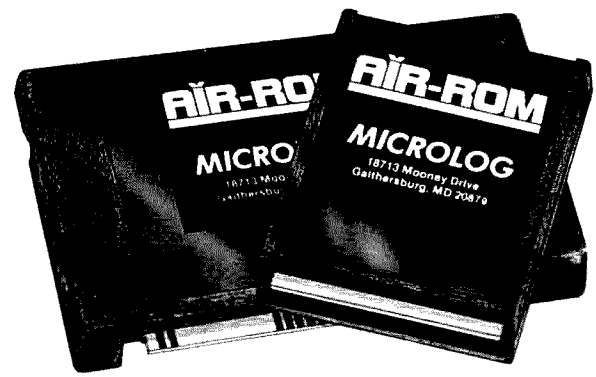
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Administering the Novice Exam

Put back some of the pleasure you've taken from amateur radio—bring a Novice into the fold.

It is always nice to return something to the fraternity of ham radio, either because we like to help or because of a desire to repay the help someone unselfishly gave us. Many hams participate in emergency services, public-service communications, and the National Traffic System. Others hold ARRL district offices, are members or elected officers of local ham clubs, serve as volunteer examiners (VEs), or are Novice/upgrade instructors.

With so much to do in ham radio, one of the finer pleasures, I believe, is the training, testing, and licensing of new hams. Getting someone started on the road to the high adventure of ham radio is a rewarding experience for those who take the time to participate.

With the advent of the recent VE program, ham licensing is easier and quite a bit more convenient than it ever was. Not changed, however, is the Novice licensing program.

To get up on the first rung of ham radio, the candidate must acquire these minimum skills: sending and receiving Morse code at a speed of 5 words per minute, and the lowest level of knowledge pertaining to FCC rules, safety, simple operating procedures, and basic electrical principles. Before the ham aspirant can get on the air, that minimum amount of knowledge must be demonstrated in a test.

The written portion of the Novice exam is very plainly laid out in the widely available American Radio Relay League publication, "Tune In The World With Ham Radio" (complete with 5-wpm code tape, $10, ARRL Headquarters, Newington CT 06111). The questions and answers from the Novice examination pool are in the publication and can be mastered in a few evenings of reading. Separate copies of the question pool can be obtained from either any FCC Field Office or the ARRL at no cost.

Code practice is accomplished by listening to the accompanying ARRL tape or through the purchase of other tapes available through the advertising pages of the various ham magazines such as *73*, *QST*, or *CQ*. When the Novice candidate is ready for testing, he or she must find a General-class (or above) licensed amateur who will prepare and administer the Novice test. The candidate must have an FCC Form 610 (June 1984) or the examiner may request one from either the ARRL or the FCC (PO Box 1020, Gettysburg PA 17325). Candidates usually do not have or know how to obtain Form 610, so help may be needed.

" 'How'd you do on the code test?' I asked. 'What test?' the candidate asked. 'The one you just took!' "

In addition to being General class or above, test administrators must be 18 years of age or older, must not be related to the candidate, and must not have an interest in the manufacture or distribution of ham equipment. These restrictions mean that you cannot give the Novice exam to your wife or to a family member—a handicap, but a necessary one to prevent nepotism.

So, as a qualified Novice examiner, how does one give the test? It is quite simple. Utilize the Element 1A pool of 200 questions. This may be provided by the candidate or you may obtain your own. Ask for "PR Bulletin 1035-A."

The question pool has been subdivided into 20 blocks of 10 questions each. The applicant must answer one question from each of the blocks. The selection of the questions is up to the examiner. A passing grade is the correct answering of 15 or more questions.

The examiner may use any method of administering the test—including single answer, multiple choice, or essay type. He may conduct the test on an oral-interview basis or with a written form with a fill-in-the-blank or true/false format of his own construction.

The code test is administered prior to giving the written test. The examiner must determine that the candidate can receive code at the speed of 5 words per minute. This can be done by any method, usually by tape or key. The code may be sent for 5 minutes. I usually send plain conversational messages in the old format of name, callsign, QTH, RST, and weather report—as is normally encountered in the traditional opening lines of an initial contact. It doesn't matter what you send as long as the candidate can copy you.

Following the 5 minutes of sending, the examiner can ask 10 questions pertaining to the code text. The candidate must answer 7 of the 10 correctly to pass. As an alternative method, the examiner may ask for one minute of solid copy of a 5-minute string of random groups of characters. This means that the candidate must have at least five correct words in a row copied without error.

We must be fair to the candidate and

ourselves. There is nothing to be gained by passing a candidate if he really cannot copy code. We would be doing both the prospective ham and the ham community a great disservice. What we are really trying to determine is whether or not the candidate is ready to get on the air in the proper manner. That is what licensing is all about.

I have given many code tests. Usually, I send code at a speed measured by looking at the second hand on my wristwatch. It may not be a highly accurate method but it should be close enough. I usually manage to squeeze five words of five-letter length in one minute. Over a period of five minutes, any inequities should balance out. In most cases, five words per minute is easily judged by most General-class license holders.

I make up my own QSOs and follow by allowing the candidate all the time he needs to make sense of the text he has copied. Then I present the ten standard questions: "Who were you talking to? What age? What callsign? etc." The method seems to be fair, and if the candidate can honestly copy code he should have no trouble passing.

The last time I administered the Novice code test I deviated from my standard practice. As thousands of hams have done in the past, I gave the test in my ham shack at home. The candidate arrived, carrying his own newly acquired transceiver. He asked if we could set it up and try it out. Yes, that would be fun. Together, we hooked it into my antenna and swr meter, then went through the tuning procedure. I was a bit surprised to see the swr nearly top the scale. Had we forgotten an important step in the tuning procedure? We repeated the steps. Still the swr was alarmingly high. Was it the candidate's new rig? Then the embarrassing moment arrived when I discovered that my antenna switch was turned to the wrong antenna!

The candidate had a fine new hand key that he had mounted on a heavy brass mount. We plugged the key in and I sent out a few V's, then a QRL followed by CQ on low power. Nothing. Then, a few kHz up the band, I answered a rather erratic CQ at about 8 to 9 wpm. I returned the call, and my 10 Watts of power was picked up by a Novice about 150 miles away.

I threw a pencil to the unwary candidate and told him to copy for me. I sent QRS and cut my speed to 5 wpm. The operator at the other end didn't understand my request so I repeated it in plain text: "Pse slow down, I am very nervous." The operator came back at a slightly slower speed, but still very erratic and with many errors. Back again I went, "Please slow down, I have a Novice candidate here in the shack and he is trying to copy you." This was followed by my QTH, name, etc. The other operator came back with his information. I watched as the candidate unknowingly took his code test.

When we signed and sent our 73, I secured the rig.

"How'd you do on the code test?" I asked.

"What test?" the candidate asked.

"The one you just took!" I looked at the piece of paper he had copied the entire QSO on. It was all there, complete with mistakes! The other operator sent his share of L's for F's, G's for W's, and other common beginners' errors. It was his third time on the air! An on-the-air communication had taken place. It wasn't perfect. There were even QRM and QRN to put up with.

I asked the standard 10 questions. Who? Where? RST? WX? Callsign? It was good copy—not solid copy, but good enough to get the information needed.

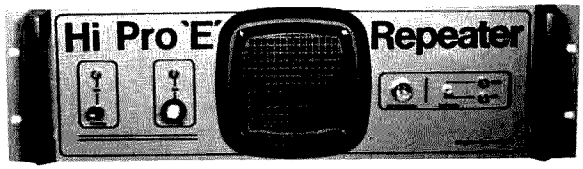
The questions I selected at random from the question pool were answered 100% correctly. It was a painless examination for both the candidate and the examiner. We filled out the Form 610 together, carefully and block by block. I didn't want the form to be rejected due to some minor error or oversight. It has not happened to me in the past, but it would be very disappointing for the candidate.

With the 610 safely filled out and signed, I dropped it in the mail the following morning. If all goes well with the U.S. Postal Service and the FCC issuing office, the license should come back within 30 to 40 days. Then we can welcome a new Novice into the fraternity. ■

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• AN EXTENSION PANEL IS AVAILABLE FOR LOCAL MONITORING OF THE REPEATER AND CONTAINS ALL NECESSARY METERING, STATUS LIGHTS AND INDICATORS. ALL ADD ONS ARE AVAILABLE FROM THE COMPANY AND ARE COMPLETE INCLUDING INSTRUCTIONS. THE Hi Pro "E" IS AVAILABLE IN NOVEMBER.

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Troubleshooting With the DMM

A short course on checking diodes and transistors, complete with pictures.

The pocket digital multimeter (DMM) is the ideal test instrument with which to locate a defective transistor or diode in your favorite project, receiver, or consumer electronic equipment. A suspected diode or transistor can be tested within seconds—whether in or out of the circuit —with the diode test. Most DMMs have a diode-transistor test on the function-selector switch marked with a diode symbol. A DMM can be purchased for as little as $39.95.

Besides transistor and diode tests, accurate voltage and resistance measurements can be made. Very low voltage or resistance measurements are required in solid-state equipment. Accurate forward-bias readings of an NPN or PNP transistor are made easily with a DMM, and low collector or emitter voltage measurements can quickly identify a leaky or open transistor.

DMM Operation

Although a few digital multimeters have a regular transistor test, most meters have a diode test which can be used to check the voltage drop at any junction of a transistor. A diode can be checked for open or leaky conditions, while transistor tests can identify open or leaky conditions from any two elements of the transistor. A junction passes the test with a low reading in one direction and a very high reading or an over-range display in the other direction. The diode-test function can check

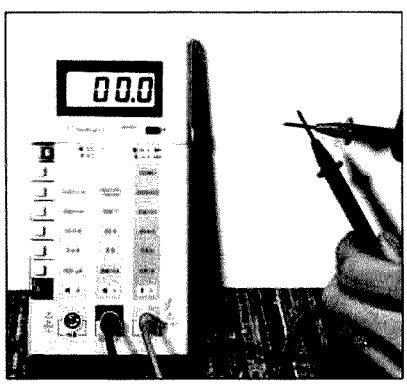


Photo A. Short the test probes together to zero the display before attempting to test the suspected diode or transistor.

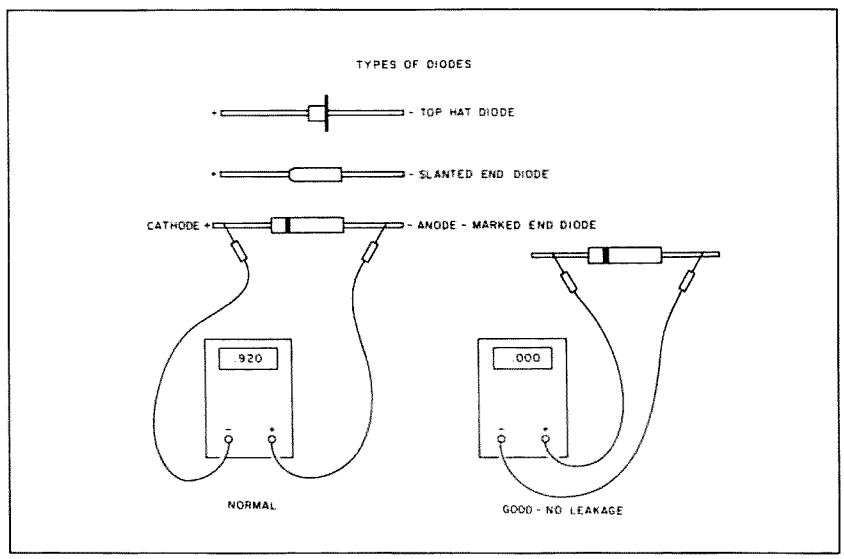


Fig. 1. A normal diode will display a value with the positive lead at the anode and the negative probe at the cathode.

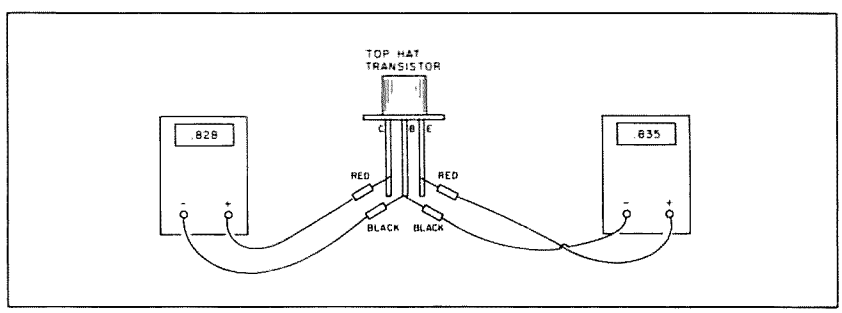


Fig. 2. The PNP transistor is tested in the same manner as is shown in Photo E, except that the negative probe is left on the base terminal.

semiconductor junctions in both diodes and transistors.

Practically every pocket DMM has a liquid-crystal display (LCD) that can be seen under strong lights. These displays are battery operated and have low current consumption. In some models, a weak-battery indicator will appear on the left side of the display. The DMM can operate from 3 to 9 volts for 150–200 hours of continuous use, making the small digital multimeter ideal for even big servicing jobs.

The voltage input range is from 0 to 2,000 volts dc and up to 1,000 volts ac. A fraction of 1 volt can be checked with .5% accuracy.

The resistance range can vary from 0 to 20 megohms with 1% accuracy. The 0–200-Ohm range will quickly check the .47-Ohm resistors found in audio-output transistor circuits. The current range can vary from 200 uA to 10 A with 1.2% accuracy.

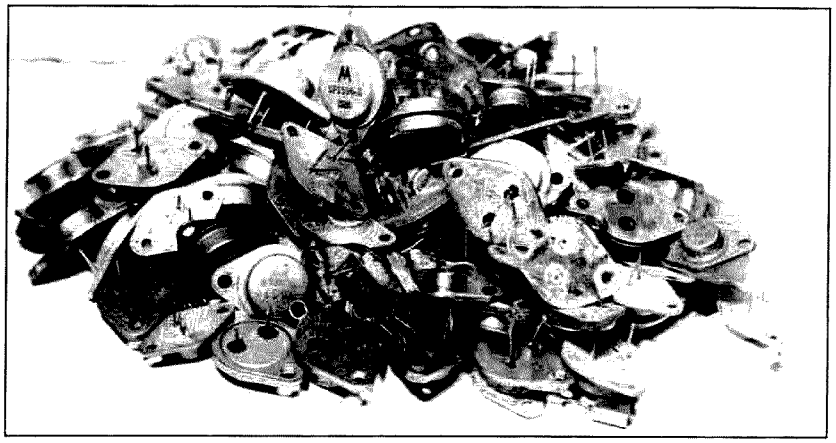


Photo B. Transistors come in many sizes and shapes. Here is a pile of defective transistors taken from a TV, radio, tape player, car radio, and various audio units.

How to Test a Diode

The suspected diode can be checked rapidly in or out of the circuit. With an in-circuit test, make sure a transistor, low-value resistor, transformer, or coil winding does not parallel the diode to be tested. If a transistor or resistor is found across the diode's path, a low reading may be found in both directions, indicating that the diode is leaky and is producing an incorrect measurement. When in doubt, remove one end of the diode from the circuit.

Rotate the DMM function switch to the diode-test position. You may find a push-button or rotary-function switch to engage the diode test. Check the zero of the meter by shorting the two test prods together (Photo A).

To test the diode, place the positive (or red) test probe to the anode terminal and the negative (or black) test lead to the cathode (see Fig. 1). The meter should produce a voltage-drop display on the LCD with a normal diode. Now, reverse the test leads. If the over-range display comes on, the diode is good. A normal diode junction will indicate a voltage drop in only one direction.

A leaky diode will indicate a low measurement in *both* directions. This indicates that current flow is occurring in both directions. A leaky diode usually has a resistance from 1k to 2k Ohms.

When the measurement is doubtful or a normal reading is not obtained, remove one end of the diode from the circuit. Now take another diode check. If high leakage is suspected, rotate the meter function to the 20k-Ohm range. With a normal diode, you should have a low-resistance measurement in one direction and very high resistance with the test leads reversed.

All fixed diodes, including zeners, can be checked with the above tests. Some damper diodes found in TV horizontal circuits can be checked like any fixed diode, while the old boost diode may not indicate a measurement in any direction. High-voltage stacks made up of layers and layers of seleninum diodes cannot be tested on the normal range of the DMM unless the diode is leaky.

Testing Transistors with the DMM

Transistors come in many sizes and shapes (Photo B). It does not matter what size or shape the transistor is; each can be checked with the diode and transistor test of the DMM. Most transistors in a defective radio can be checked in the circuit within a few minutes. Simply switch the meter to the diode or transistor function and place the probes on two transistor elements.

Place the positive lead of the DMM on the base terminal and the negative lead on the collector terminal of an NPN transistor (Photo D). You should have a resistance reading. Now place the negative probe to the emitter terminal, with the positive lead at the base terminal (Photo E). A similar measurement indicates that the transistor junction is good. If one of the values is really low, a leakage exists between the two elements.

To test a PNP transistor, place the negative probe to the base terminal and the positive lead to the collector terminal and note the value (Fig. 2). Leave the negative probe at the base terminal and move the positive probe to the emitter terminal. The transistor is normal when the two values are about the same.

The defective transistor may be leaky or open and still appear normal. The transistor junction may be open between the base and collector, or the base and emitter terminals (Photo C). The base terminal is common to the other two elements. You may find a leakage reading between any two elements; the emitter-to-collector terminal is the most common culprit. A normal reading between the base and the other two elements will show a voltage drop in only one direction.

Most transistors can be checked very rapidly in the circuit with the DMM, but a low-resistance path between any two elements, such as a coil, transformer, diode, or low-value resistor, may cause an erroneous reading. Again, when in doubt, lift the emitter terminal from the circuit and make another test.

The Open Transistor

The open transistor will have infinite resistance between the open elements. It's possi-

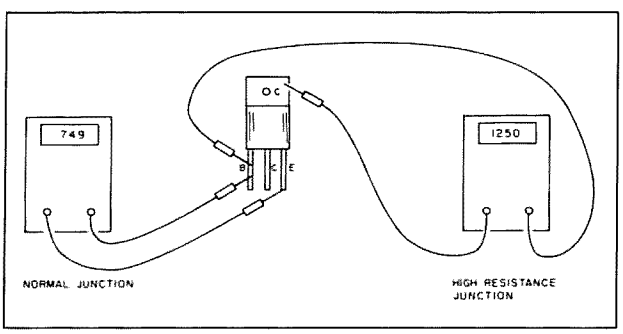


Fig. 3. Although a value might be seen on the display, indicating a junction reading, if the two measurements are not quite close, suspect a high- or low-resistance junction. Replace the transistor.

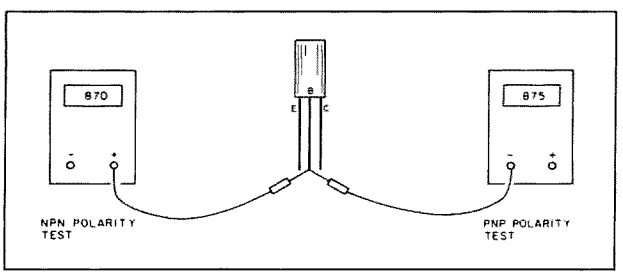


Fig. 4. An NPN or PNP transistor can be identified by observing the polarity of the test leads that result in a display on the DMM.

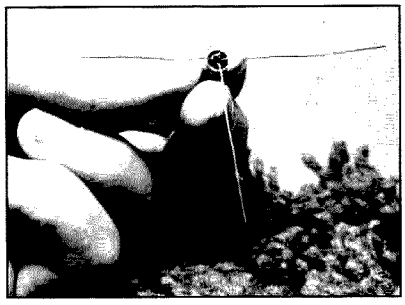


Photo C. The base terminal (bottom center) of the transistor is a common test point for measurement between the collector (top left) and the emitter (top right). A normal transistor will drop voltage in only one direction.

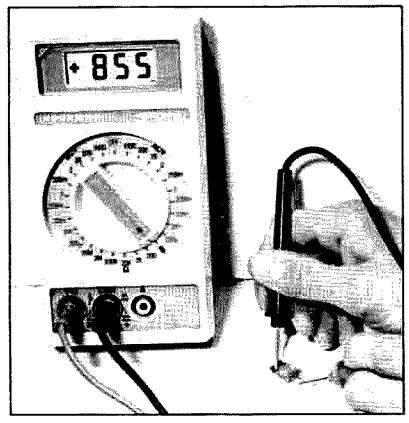


Photo D. Place the positive probe on the base terminal and the negative lead on the collector terminal of an NPN transistor. If the transistor is normal, a measurement can be read.

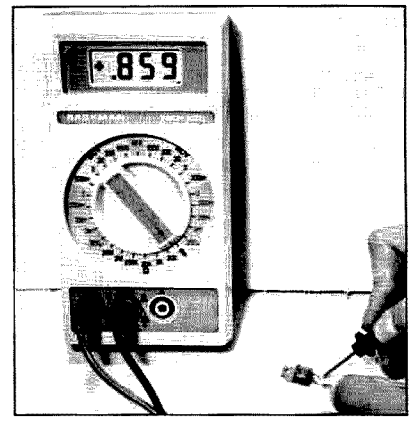


Photo E. Now place the negative probe to the emitter terminal with the positive lead at the base terminal. If the transistor is good, the value should be close to that observed at the collector.

ble to see a normal junction reading between the base and collector terminals and an open indication between the base and emitter terminals. Likewise, an infinite resistance between the base and the collector indicates that the transistor is open.

A transistor never becomes weak like a tube. A poor or high-resistance junction may indicate a defective transistor between the base and either the collector or emitter terminal. For instance, the measurement between the base and emitter terminals may appear normal in an NPN transistor (Fig. 3). When the negative probe is attached to the collector terminal, the reading may be quite high, indicating a high-resistance internal junction. Remember that both measurements should be quite close in a normal transistor.

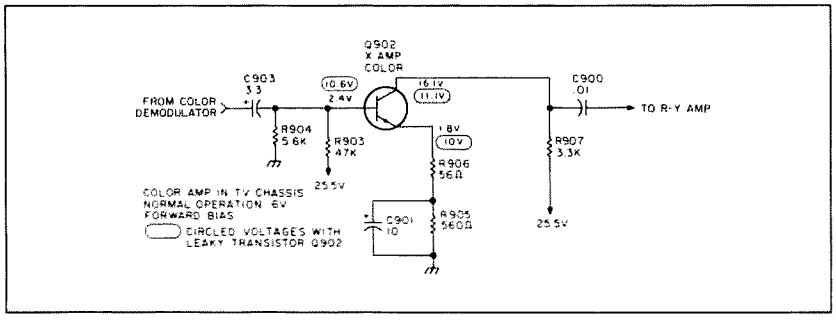


Fig. 5. Critical voltage measurement on the suspected transistor may determine if a transistor is leaky or open. Here, the voltages are quite close on all elements, indicating a leaky transistor.

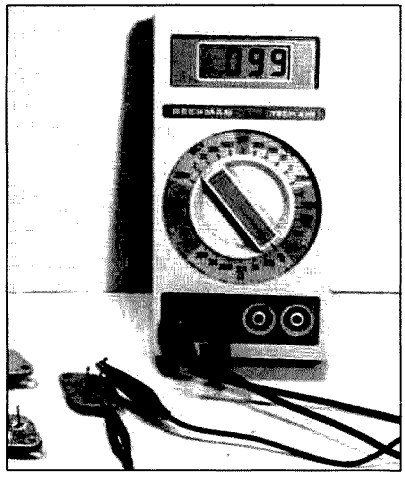


Photo F. A leaky transistor may show a low reading between any two elements in both directions. Here, a 99-Ohm leakage is found between the collector and emitter terminals of an audio-output transistor.

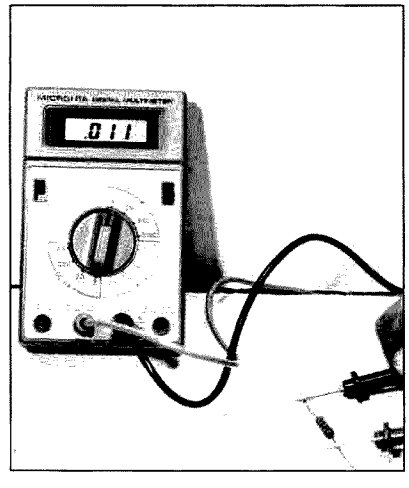


Photo G. Check all resistors for the correct value before replacement. A regular 10-Ohm replacement resistor measures 11 Ohms on the DMM low-value scale—the resistor is within 10%.

The Leaky Transistor

The transistor may appear leaky between any two elements. A leaky transistor will have a low-resistance measurement, from a dead short up to several hundred Ohms (Photo F). To test the transistors for leakage, take a measurement between any two elements. If you reverse the test probes on the same elements and get the the same low measurement, you have a leaky transistor. Leakage measurements above 500 Ohms should be measured on the 20k-Ohm scale. Often the trouble exists between the collector and emitter terminals. Always replace the leaky transistor!

The Intermittent Transistor

A poor junction or internal terminal lead of a transistor may produce an intermittent circuit. Intermittent problems within any electronic device or project are very difficult to locate. Sometimes the intermittent transistor will act up only under load. When tested in or out of the circuit, the transistor may appear normal. Sometimes the transistor will test as intermittent in the circuit, and when removed for accurate tests, the transistor returns to normal. Always replace the transistor under these conditions.

Besides transistor tests, the intermittent transistor can be located with accurate voltage measurements or coolant. Spray several coats of coolant on the suspected transistor—the transistor may turn on and off.

NPN or PNP Identification

In a radio or receiver without markings on the transistors, it is difficult to tell if the transistor is an NPN or PNP type. The identity of any transistor can be quickly determined with the DMM. Remember, if a reading is indicated with the positive lead of the meter on the transistor's base, and the negative lead alternating between collector and emitter, the transistor is NPN (Fig. 4).

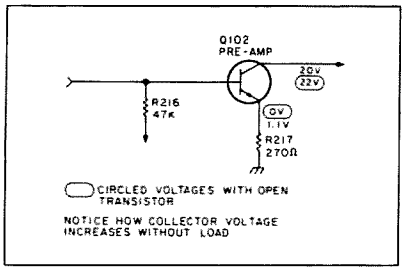


Fig. 6. The high collector voltage indicates an open transistor or emitter resistor (R217). Check the emitter resistor with the low-Ohms range of the DMM.

Once the base terminal is located, the collector and emitter terminals can be identified with voltage measurements. Often, the collector terminal will have a higher positive voltage with an NPN transistor, and the emitter terminal will have a very low voltage. In receivers and audio circuits, the emitter terminal has a low-value resistor between the emitter and chassis ground. Sometimes in TV circuits the emitter terminal itself is grounded.

Transistor Voltage Measurements

Accurate voltage measurements may indicate if a transistor is open or leaky. Suspect a leaky transistor when the voltages are similar at all three terminals (Fig. 5). A higher than normal collector voltage may indicate an open transistor. A low voltage at the collector terminal may indicate a leaky transistor or an improper voltage source. Check the voltage at the emitter terminal—no voltage may indicate an open transistor or emitter resistor. Check the emitter-bias resistor using the low-resistance scale of the DMM.

With the transistor in operation, measure the bias voltage between the emitter and base terminals. Be careful not to short the two terminals! An NPN transistor will have a .6-volt measurement, indicating that the transistor is normal, while the forward-bias voltage of a PNP transistor is only .3 volts. In most cases, when an accurate forward-bias voltage is measured between the base and emitter terminals, you can assume that the transistor is normal. Today, most commercial electronic systems use NPN transistors exclusively.

Resistance Measurements

Resistance measurements within the transistor and diode circuits are quite accurate when using the DMM. The low-resistance range may be used to check for open emitter-bias resistors in TV and audio circuits (Fig. 6). No voltage on the collector terminal of the transistor may indicate an open collector resistor or coil winding.

It's best to remove one end of a resistor and then check for correct resistance. Check the replacement resistor for the correct value before installing it (Photo G)—you may have misread the color code or the resistance may not be what is marked.

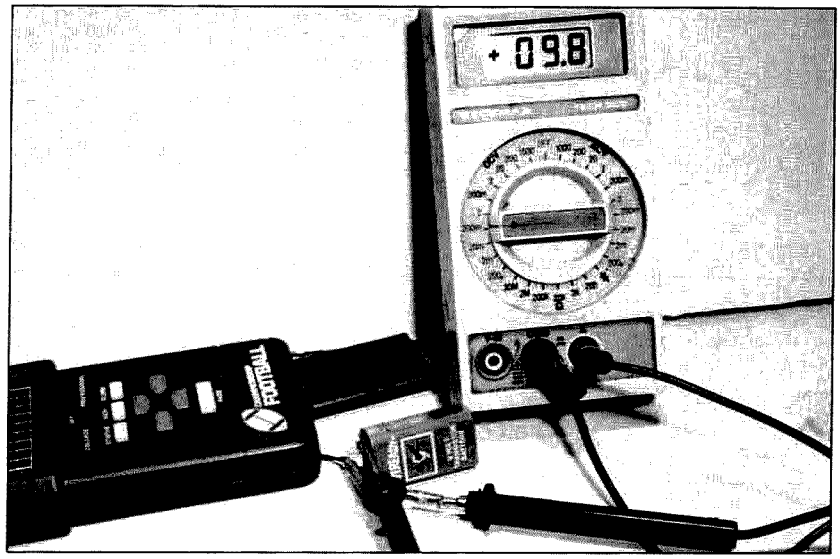


Photo H. Check the current drain if batteries die quickly.

DMM Problems

After many hours of use, your digital multimeter may come up with a few service problems. If measurement is erratic or there are no resistance or voltage measurements, suspect a broken test lead. The probe leads tend to break right at the end of the probe, or where the lead enters the banana jack. Cut off the broken lead and repair the probe terminal. Sometimes it's best to have another set of test leads handy if the meter is used a lot.

Erratic or intermittent measurements may be caused by the banana-type plugs on the meter. Sometimes these plugs get dirty and cause erratic readings of the meter. Rotate the function switch to the low-resistance scale. Hold the test probe together to get a zero reading. Now, flex the cable and move the plugs at the meter. Suspect dirty contacts if the meter reading rapidly changes. Clean up the female contact jack and spread the male banana plug sections for a tighter fit.

A dim LCD may be caused by a weak battery. Some DMMs have a battery indicator that produces a signal when the battery becomes weak. The LCD letters or over-range value will be really dark with a set of new batteries. If the digital multimeter is not used very much, the batteries may become defective from normal shelf life.

How to Check Power-Supply Circuits

Shorted or leaky diodes are a common problem in low-voltage power supplies. The leaky diode can blow the fuse or destroy the primary winding of a transformer in radios or tape players. Sometimes lightning strikes the power line and destroys the silicon diodes. You may find two diodes in a full-wave rectifier circuit or four in a bridge-rectifier circuit (Fig. 7).

Use the diode-test position of the DMM. Lift one lead of each diode in the circuit. A normal diode will show a resistance measurement in only one direction. Replace each

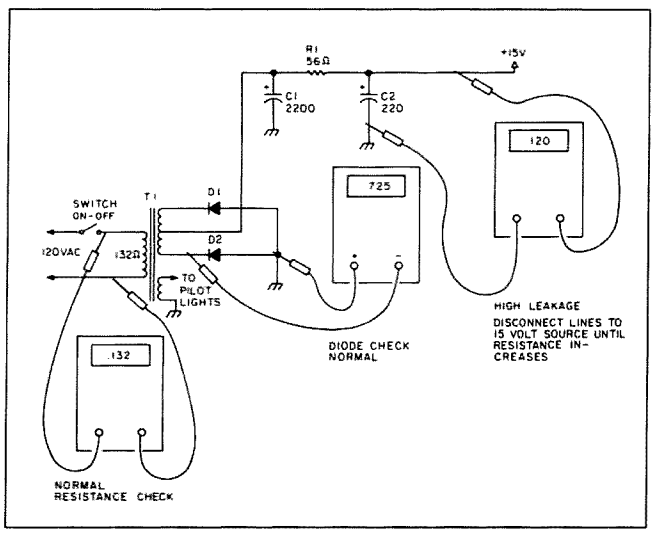


Fig. 7. You may find two diodes in a full-wave rectifier with four diodes in a bridge-rectifier circuit. Remove one end of each diode for leakage tests.

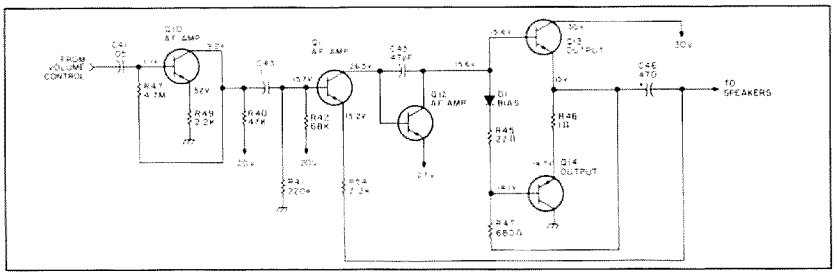


Fig. 8. All transistors in the audio circuit can be checked very quickly with the DMM. Check bias diodes and resistors if the sound is distorted.

leaky or shorted diode. The diode body area may be burned or damaged, indicating lightning or heavy-current damage.

Check the resistance of the primary winding of the transformer (T1) if one or more diodes are leaky. Sometimes a dead short on the secondary winding will open up the primary winding of the transformer. If the diodes appear warm after installation, check the power-supply load or connecting circuits for possible leakage. C1 may be leaky. Check the resistance across C1 for a low measurement. Remove all the load wires connected to the positive terminal of C1 if a very low resistance is found. Then check each connecting load wire for the shorted component.

How to Check Audio Circuits

Some type of an audio circuit is found in practically all consumer electronic products. Dead, weak, or distorted audio circuits can be checked within minutes with the digital multimeter (Fig 8). Here is an audio-circuit service procedure: Quickly check af amps Q10, Q11, and Q12 with the diode-transistor test of the DMM. These three transistors can be checked in the circuit without any problems. A leaky or open af transistor may cause a weak or dead audio circuit.

Quickly check Q13 and Q14 in the circuit for open conditions. If leakage is noted between two elements, remove the transistor and test it out of the circuit. A leaky or open output transistor may produce a weak and distorted sound. Check each bias resistor (R46, R45, and R47) with Q14 out of the circuit. Often, a leaky or shorted transistor may destroy the bias resistor. Remove one end of D1 and check for leakage. A leaky bias diode may cause distortion in the sound. By now you should have located the defective component.

How to Check Your Favorite Project

You can quickly check out your favorite project or game machine with the digital multimeter. Simply check all transistors and diodes for proper values. Take critical voltage measurements on the transistor terminals and also determine if the correct voltage source is being fed to the integrated circuits.

Various resistors and momentary push-button switches can be checked for continuity with the low-value scale. Often, a dirty or poor switch contact may prevent a project from working. Lift one lead of the resistor.

When the project will not operate, suspect a leaky component that is causing the unit to draw excessive current. If the project is operated from batteries, measure the voltage across the battery terminals with the unit operating. A low battery reading may indicate a defective component. Place the test probes of the DMM in series with the battery leads and take a current measurement (Photo H).

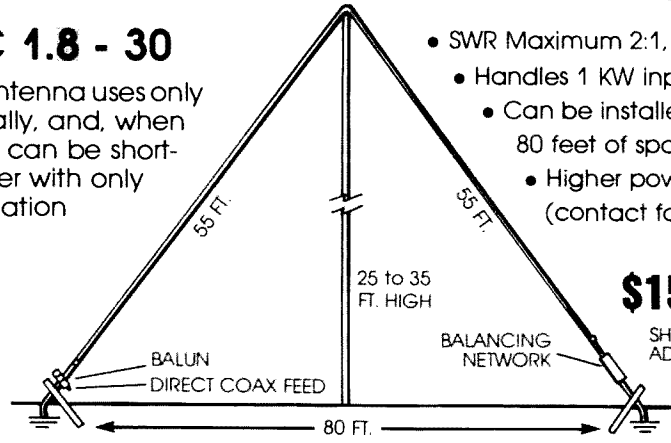
Remember, your project may not work because of a *new* defective part! Just because the component is new doesn't mean it's okay. Check it out with the DMM. If your favorite project is collecting dust, dig it out, dust it off, and give the DMM a try at locating the defective component or bad connection. ■

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Greg Swain

Kit Corner: The DSE Radio Direction Finder

Excerpted with permission from the February, 1986, issue of Electronics Australia.

Most readers will be broadly familiar with the concept of a radio direction finder (RDF). A basic RDF consists of a receiver and an antenna which can be rotated on its own axis. The direction of the transmitter is found by rotating the antenna for a signal peak or null.

You can easily demonstrate the effect for yourself using a portable transistor radio fitted with a ferrite rod antenna. By tuning the radio to a station and rotating the radio about its vertical axis, a null will be found in the signal strength. The ferrite rod antenna will then point in the direction of the station.

Of course, this method requires that "fixes" be taken at two or more widely spaced locations in order to find the true location of the transmitter. The exact location of the transmitter is determined by simple triangulation.

The classic application of this radio direction finding technique was in World War II. Many war movies showed how it was possible to track down enemy transmitters using special vans fitted with RDF equipment. Typically, these vans were fitted with a large external loop antenna which could be manually rotated. An operator inside the van listened in on headphones for peaks and dips in the signal strength. Provided the transmitter remained in the one location for long enough, its location could eventually be pinpointed.

The Dick Smith Radio Direction Finder is just the ticket for tracking down illegal transmitters and antisocial radio operators. Depending on the antenna system, it can operate on any band from 50 to 500 MHz and will work with FM receivers ranging from pocket scanners to amateur radio and CB transceivers.

Physically, the radio direction finder consists of two separate units. One contains the control and display electronics, and the other is a special antenna-switching unit (ASU) which is connected to the control unit via a 4-conductor cable.

An electronic "compass" display consisting of 32 LEDs indicates the transmitter bearing. When a signal is received, its relative bearing to the antenna system is indicated by whichever of the 32 LEDs illuminates.

In fixed installations, this allows the compass bearing of the signal to be directly indicated to within ±5.6 degrees. When an RDF unit is installed in a car, successive readings allow you to pinpoint the exact location of the transmitter.

How It Works

The theory of operation is reasonably simple. Radio signals received on a rapidly moving antenna undergo a frequency shift due to the Doppler effect, an effect well known to anyone who has observed a moving car with its horn blowing.

Consider a single antenna mounted on the edge of a rapidly spinning disc (Fig. 1). As the antenna moves towards the source of the rf carrier, the apparent frequency will increase due to the Doppler effect (Fig. 2). Conversely, as the antenna moves away, the frequency will decrease.

Thus, the rotating antenna causes frequency modulation of the received carrier. When this type of antenna is connected to an FM receiver, a tone is heard. By analyzing the phase of this tone, the direction of the transmitter can be determined.

To avoid the obvious drawback of a mechanically rotated system, the Dick Smith RDF simulates a rotating antenna electronically. Four vertical whip antennas are arranged around a circle with a diameter of 0.07–0.4 wavelengths. The antennas are electronically switched clockwise in sequence such that all four antennas are scanned once every 1/1250th of a second.

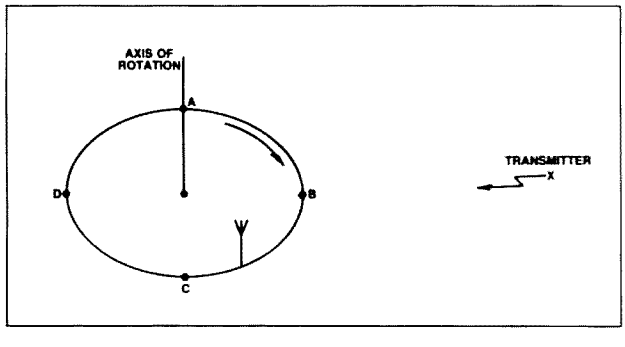


Fig. 1. Signals received by an antenna mounted on the edge of a rotating disc are frequency modulated due to the Doppler effect.

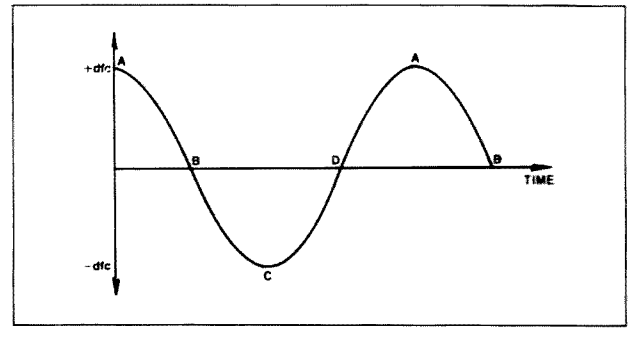


Fig. 2. This graph illustrates the frequency shift as the antenna moves towards and away from the transmitter.

This situation is equivalent to one vertical antenna mounted on the perimeter of a disc spinning at 1250 revolutions per second. A diameter of, say, 800 mm (for the 2-meter band) results in a tangential velocity of 3140 meters per second.

If the carrier frequency is 144 MHz, the carrier will deviate 1.5 kHz at a rate of 1250 Hz. For lower carrier frequencies, the deviation will be proportionally lower. Note, however, that the 1250-Hz modulating tone remains constant, as it is a function of the antenna switching rate only.

The output from the FM receiver is applied to the signal input of the RDF adapter and compared with an internal reference phase. The resultant phase angle appears as a 5-bit binary code which is decoded to a one-of-32 output to drive the appropriate LED indicator.

In addition, the detected audio tone can be monitored on an internal loudspeaker. This provides an audible indication that the receiver is correctly tuned to the transmitter frequency.

The Circuit

Antenna switching is accomplished by first deriving a 2-bit binary code from a 1-MHz master oscillator. Here's how it's done:

Inverter stages IC2a, b, and c (4069) form the 1-MHz oscillator, with buffering provided by IC2d. This clocks decade counters IC4 and IC7, both of which divide by five to produce a 40-kHz signal on pin 1 (CK) of IC10.

IC10 is a 4024 7-stage binary counter. Its Q1–Q5 outputs directly drive the D1–D5 inputs of IC12, a 40174 hex latch, while Q4 and Q5 also drive IC9, which is a 4555 one-of-four decoder.

What happens is that IC9 accepts a 2-bit binary code from IC10 and provides the quadrature antenna-switching signals. These signals are interfaced by a 1488 line driver (IC6). The outputs of IC6 swing positive and negative in sequence to provide bias for the matrix diodes (D201–D208) in the antenna-switching unit (ASU).

The diode matrix is arranged so that, at any given instant, three of the antennas are effectively shorted and only one is coupled to the receiver. For example, when pin 11 of IC6 is low (−9 V), D205–D207 are forward-biased and short out antennas 2 to 4. At the same time, D201 will also be forward-biased while D202–D204 are turned off. Antenna 1 will thus be connected to the receiver.

The detected audio tone from the FM receiver is applied to the input of the RDF adapter, limited by D1 and D2, and filtered by a single-pole active low-pass filter stage (IC5). This chip is described by National Semiconductor as an MF5 Universal Monolithic Switched Capacitor Filter. Basically, it is a general-purpose active-filter building block.

The rest of IC5 is configured as a second-order bandpass filter to remove unwanted audio modulation from the 1250-Hz tone. The center frequency of the filter is set to 1250 Hz by the clock signal applied to pin 8. This clock signal is derived via IC3, which divides the 1-MHz master oscillator signal by eight.

Note that the clock for the bandpass filter is derived from the same source as that used to switch the antennas. This means that the filter is automatically centered on the scanning tone, even when there is some frequency drift.

The output of IC5 (pin 1) is a sine wave with a nominal frequency of 1250 Hz. This signal is applied to op amp IC11a, which functions as a phase shifter. Adjustment of the phase shifter is by means of VR1.

The job of the phase shifter is to allow calibration of the circuit and to compensate for any audio phase shifts in the receiver.

From there, the signal is further processed by a 4046 phase-locked loop (PLL). The function of this stage is to average out any modulation present in the passband of IC5 and to produce a 1250-Hz square wave which is essentially free of noise and jitter.

It is this signal that is used to latch IC12. The output of the PLL (pins 3 and 4) is first inverted by IC2f and applied to D-type flip-flop IC13a. Subsequently, when the flip-flop's D input goes high, IC13a latches IC12 on the first positive-going clock pulse from pin 10 of IC4.

The result of all this is that IC12 is latched with a 5-bit code that is directly related to the transmitter direction. A phase-comparator function is thus performed.

Note that IC13a is necessary to prevent the latching signal from coinciding with a change of data on IC12's inputs.

A pair of 74LS154 one-of-16 decoders (IC101 and IC102) on the display board converts the 5-bit code to a one-of-32 output. These decoders directly drive the 32 display LEDs to indicate that transmitter position.

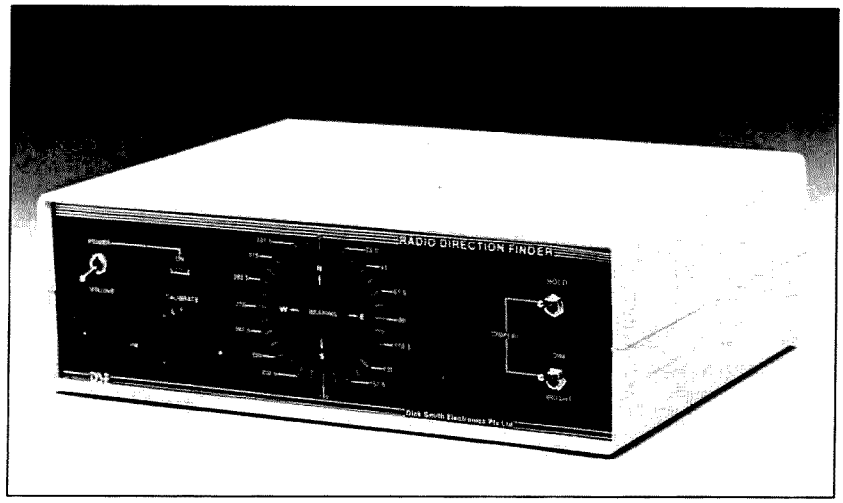
Switch SW102 allows the display to be held or "frozen" by resetting IC13a. SW101 serves as a power on/off switch, while SW103 allows the display to be dimmed by switching a 330-Ohm resistor into the common anode circuit of the LED display.

To make the unit as easy as possible to use, the audio output from the FM receiver is also fed to an internal loudspeaker. The volume is adjusted by means of potentiometer VR102, which is mounted on the front panel.

Power Supply

Power for the RDF unit is derived from an external 12-V source which connects to a 2-conductor socket on the rear panel. This supplies +12 V direct to several ICs and to the input of 3-terminal regulator IC1. IC1, in turn, supplies a regulated +5-V rail to the remaining ICs.

Op amp IC11b provides a buffered +6-V rail to IC5 and also to the phase-calibration control (VR101).



The Dick Smith Electronics Radio Direction Finder.

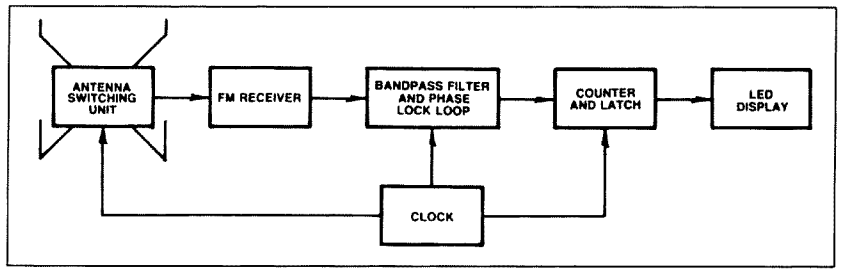


Fig. 3. Block diagram of the Radio Direction Finder. Signals from the antenna-switching unit are fed to an FM receiver and the output is compared to a reference phase.

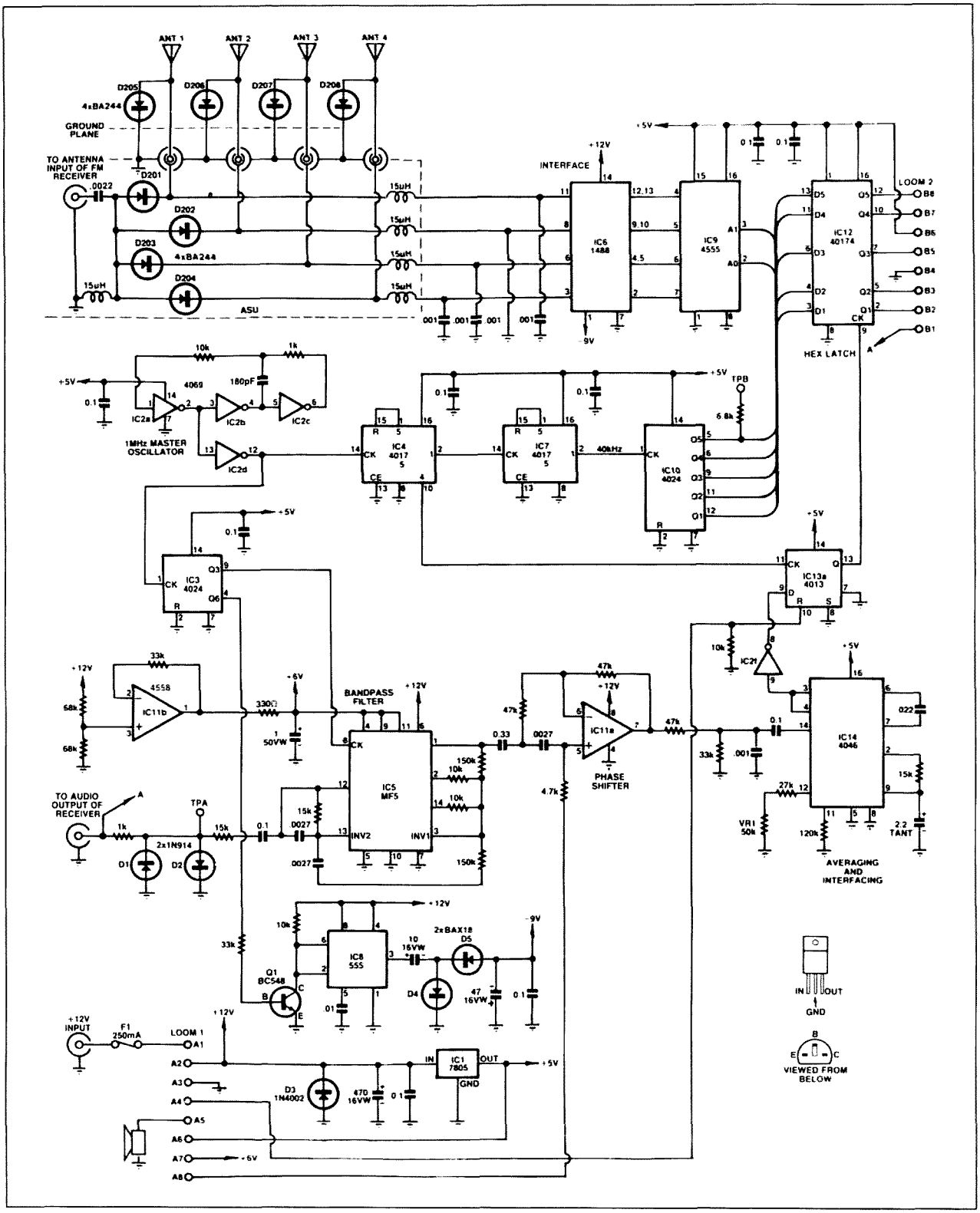


Fig. 4. The control and antenna-switching circuitry.

Finally, a −9-V supply rail is required for the 1488 line-driver IC. This is generated by a dc-to-dc converter circuit based on 555 timer IC8. It buffers a 16-kHz square wave derived from IC3 and drives a diode charge pump based on D4 and D5 to produce the required −9-V rail.

Transistor Q1 simply functions as a switch. Its job is to interface the +5-V CMOS circuit to the +12-V timer circuit.

Construction

Construction is straightforward, with most of the parts mounted on three PC boards, two in the main unit and one in the ASU.

A plastic instrument case fitted with a per-

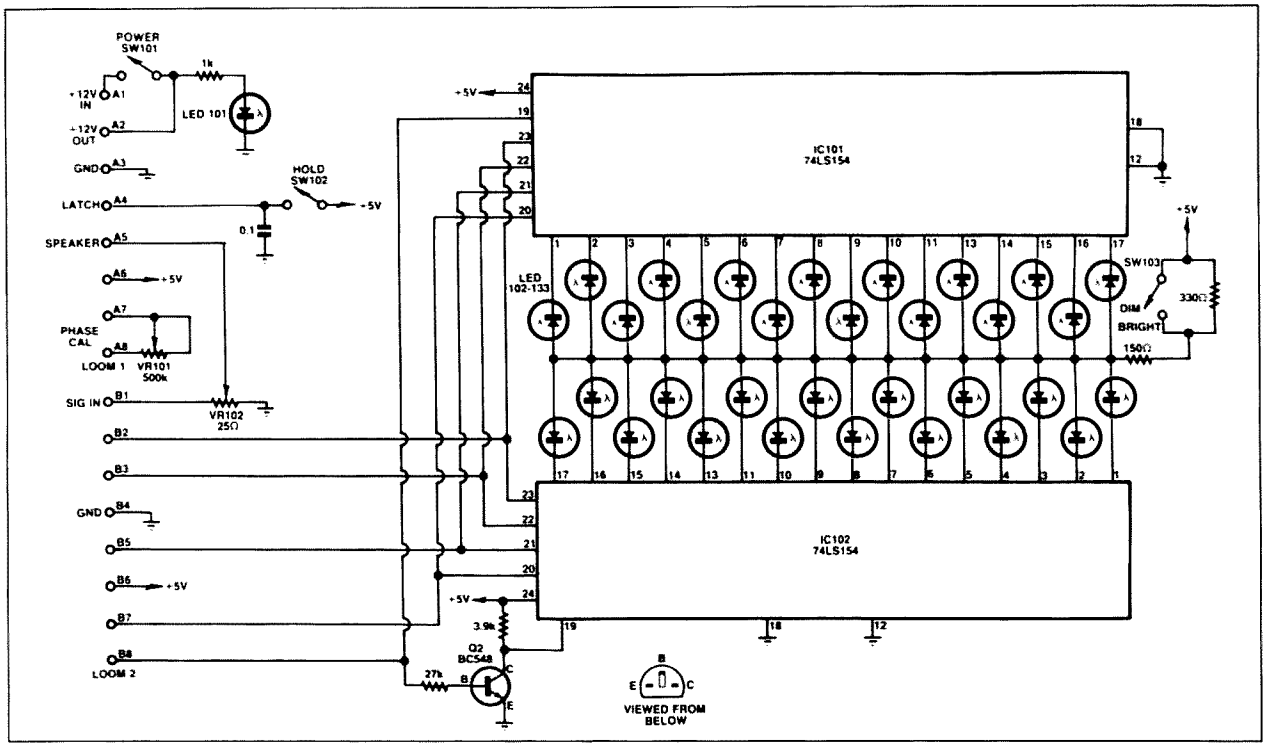


Fig. 5. The display circuit.

spex front panel houses the control electronics, while the ASU board is housed in a plastic project box.

Connections between the ASU and the control unit should be run using 4-conductor cable, while the connection to the FM receiver should be run using coaxial cable. All you have to do is trim the cables to the desired lengths and terminate them with the appropriate plugs.

Note that the wiring connections to the plugs at both ends of the control cable must be made on a one-to-one basis, otherwise the antennas will not rotate in the correct sequence.

Setting Up

An alligator clip lead and a small screwdriver are all that is necessary to adjust the unit.

Connect up a 12-V supply (be careful of polarity!) and switch on with the hold off and the ASU disconnected. All the LEDs in the display should rapidly flicker on and off as the display is scanned.

Assuming all is well, connect the two test points (TPA and TPB) together using the clip lead and adjust VR1 until a single LED is latched. Confirm this adjustment by unhooking and reconnecting the clip lead.

If the display does not latch when the test lead is reconnected, repeat the above procedure. This adjustment brings the vco to within the capture range of the PLL.

Note that, with the calibration control at mid-position, the latched LED should be the one at the top of the circle.

ANTENNAS AND OPERATION

For mobile operation, four 1/4-wave vertical whip antennas attached to a roof-rack assembly would be the best approach. The ASU could then be conveniently located between the antennas. It should be weather-proofed using a silicone sealant.

In most cases, a separate ground plane will have to be provided adjacent to the antenna bases. A suggested method is to secure a sheet of aluminum to the roof-rack. Make sure that the assembly cannot come loose!

A hand-held transceiver can be used to aid the initial setting-up procedure. Depending on the setup, it may be necessary to rotate the antenna array until the compass rose reads true relative to the direction of the vehicle.

The calibration control can be used to make the final adjustment. A walk around the antenna array with the hand-held transceiver will then reveal if the installation is functioning correctly. This should take place in an open area to avoid strong signal reflections.

In the case of a fixed installation, four ground-plane antennas should be mounted symmetrically on a vertical mast, together with the ASU. The array can then be adjusted so that the compass rose displays the true bearing with the calibration control set to mid-position.

Note that, in either case, the distance between opposing antennas should be between 0.07 and 0.4 wavelengths.

If a dual-trace oscilloscope is available, VR1 can be adjusted for a 90° phase angle between the signal input (pin 14, IC14) and the PLL comparator input (pin 3, IC14).

Finally, the control unit can be checked out by connecting outputs 1, 2, 3, and 4 (to the ASU) in sequence to test point TPA. First, connect output 1 to TPA and adjust the calibration control so that the latched LED is at 0°. The 90° LED should now light when output 2 is shorted, the 180° LED when output 3 is shorted, and the 270° LED when output 4 is shorted.

That completes the construction. Your Radio Direction Finder is now ready for use.

Where To Buy The Kit

The Radio Direction Finder described here was developed by the Research and Development Department at Dick Smith Electronics Pty Ltd. It is available as a complete kit of parts by mail order or from your nearest Dick Smith Electronics store.

The kit comes complete and includes a perspex front panel, screenprinted fiberglass PC boards, antenna bases, plugs and sockets, and a detailed construction manual. The cost is $99 plus postage and packing charges where applicable.

Mail orders should be sent to: Dick Smith Electronics, PO Box 8021, Redwood City CA 94063; (800)-332-5373. ■

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I have two Commodore 64s and both have served me well. In fact, I have written six books and a large . . . well, you're not here to listen to all that, but I hope you are here to learn how to fix a small problem that develops with all C-64s at some point in time.

The problem appears first as a missed character, or perhaps as a repeat character, as you type. This is most noticeable when using the computer as a word processor or in RTTY applications. A good example might be:

"Well, guesss thatss abut all here, ssure d hpe to run int yu again. 73 frm WA4BLC in Fallss Church, VA."

Notice how, on some occasions, the letter "s" repeated itself and the letter "o" was missed completely. Both instances are examples of an intermittent problem inherent in the Commodore 64 (and other similar computers).

Background

The Commodore 64 keyboard is made up of typewriter-style key caps which, when depressed, push a small piece of conductive rubber against pads on a printed circuit board (PCB), causing momentary contact. This momentary contact is recognized by the computer, and the particular letter struck will appear on the screen. It is a simple, almost foolproof system giving excellent feel to the keyboard (I compare it favorably to an IBM typewriter), and it is almost immune to accidental strikes or even the occasional physical assault keyboards tend to get.

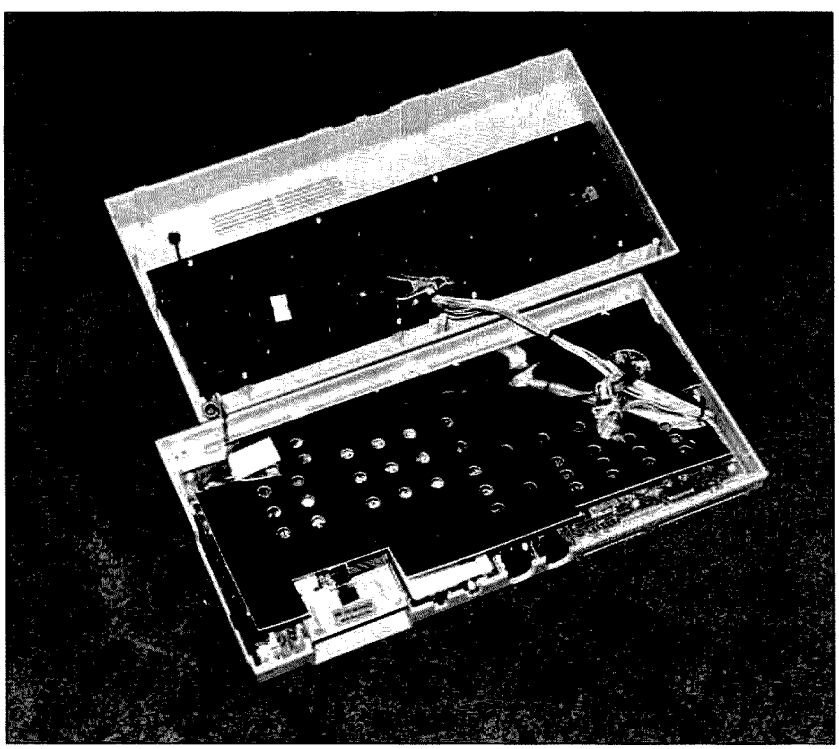


Photo A. Opened up, the bottom half, above, has the keyboard in it. Don't turn it over! Notice the wires referred to in the text that must be unplugged.

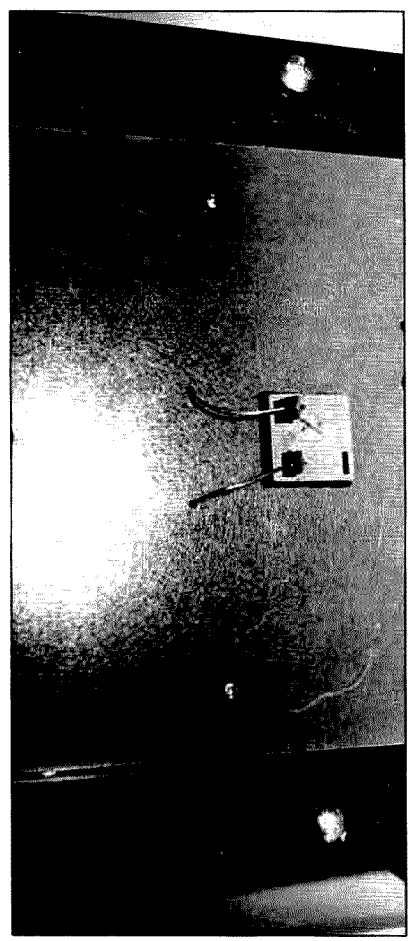


Photo B. These two wires must be unsoldered before disassembly of the keyboard PCB and resoldered when putting it back together.

However, not all is perfect, and from time to time the 64's keyboard will start to skip and stutter, driving the operator up the proverbial wall. After all, we do want our typing and RTTY to be letter-perfect, don't we?

These skips and stutters are caused by a film of oxidation forming on the contact surfaces of the keyboard's PCB. This film prevents the forming of a complete circuit when the conductive rubber contacts the PCB pads.

There are two methods of repair. The first is to take the computer to a repair center, pay the price, and wait the time. The second is to repair it yourself.

Fixing It Yourself

The following instructions are so simple that anyone with the ability to read, to handle a screwdriver, and to solder should be able to repair his own Commodore 64 keyboard.

I recommend you use a small size Phillips screwdriver for work inside the computer (Radio Shack sells kits of small tools) and a cereal bowl for the collection of parts. Use a low-wattage soldering iron—no 250-Watt guns allowed.

1) Disconnect all lines, wires, plugs, etc., from the computer and place it on your working surface with the keys facing away from you.

2) Turn the computer upside down (space bar now underneath and toward you) and remove the three screws along the edge closest to you. After the screws have been removed, lift up the bottom panel until it feels as if it is binding. This binding is caused by three snap-in latches on the back of the computer. Continue to open the computer, and these latches will snap open.

Do not turn the keyboard half of the computer shell over! Leave it face down. If you do turn it over, you will have enough pieces falling and scattering to keep you busy for several hours picking them up and putting them back where they belong!

3) Now that the computer is in two pieces, position them as shown in Photo A, with the insides of each half face up, and the half with the aluminum-foil shield closest to you.

4) Looking at the half of the computer farthest from you, you will see a long, brown printed circuit board. This is the keyboard PCB. On the left side you will see the pair of wires (red and black) which run from the pilot lamp to the bottom of the computer. Unplug this line.

5) Now look at the center of the keyboard PCB and you will see a multicolored bunch of wires. Follow these wires to where you will see them terminate with a plug. Unplug this plug also.

6) Looking on the right side of the circuit board, you will see two bare wires soldered to two lugs. Unsolder these and carefully pull them out of the lugs (see Photo B).

7) Looking at the keyboard PCB, you now will notice 23 small screws, some covered with tape. Remove the tape. Then carefully remove all 23 of the screws (place the screws in the bowl).

8) The keyboard PCB is now free of all connection. Carefully lift it from its mounting and turn it over. The circuit side is green. It is the green side that must be cleaned.

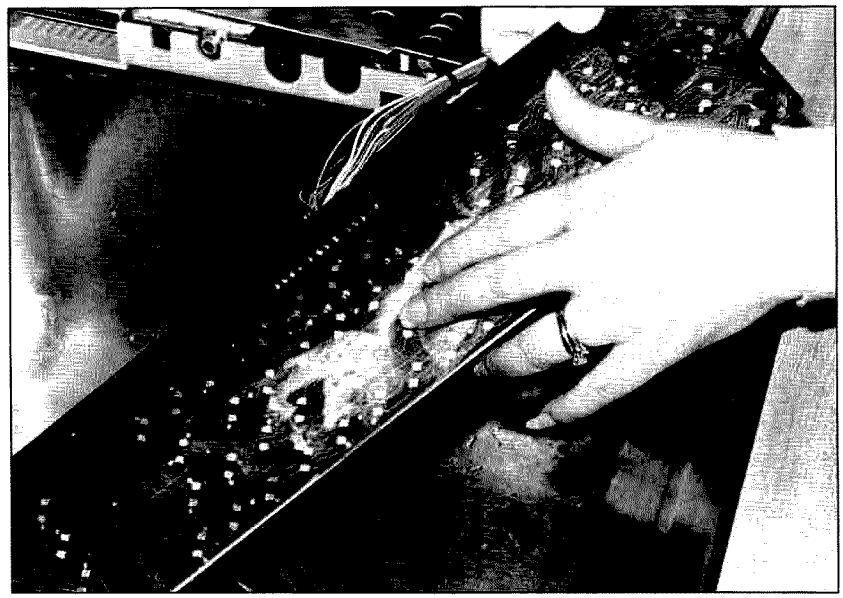


Photo C. Carefully and gently scrub the pads, as instructed in the text.

9) At the kitchen sink, carefully wet the printed circuit side of the PCB and spread about a tablespoon of mildly abrasive bathtub cleaner (the type used on fiberglass showers) over the surface. In addition to the circuit traces on the PCB, you will notice there are many small pads on the board, each about 1/4-inch square. These pads are the key-contact points that need to be cleaned. Using your fingers as scrubbers, lightly scrub each of these pads. Three or four times across each pad will be sufficient (see Photo C).

10) Rinse the circuit board with lots of cool water, then pat dry with a linen towel (linen will not leave any lint). Let the board sit in a cool, dry location for at least three hours to ensure proper drying.

11) Before reassembly, carefully blow the inside of the keyboard shell clear of any accumulated dust and dirt. This can be done with a hairdryer. About 10 seconds of air blast is all that's needed. This short blast will not allow any heat buildup.

12) Place the keyboard PCB back into place in the upper half of the computer, brown side up. There are small round tabs in each corner of the board to aid in alignment. After the circuit board is in place, insert and tighten each of the 23 screws. Do not over-tighten!

13) Resolder the two wires into their respective lugs and plug in the pilot lamp wires and keyboard wire bunch plug. (These plugs are designed to fit only one way, so don't force them.)

14) Place a piece of tape over the group of wires in the center of the PCB. Shipping tape is excellent for this job.

15) Carefully fit the top and bottom parts together, starting with the tabs on the back; reinstall the three bottom screws.

Summary

Well, you may not be a computer service master now, but you surely found a way to save a few dollars. In fact, the dollars saved range from $35 to $95, depending upon where you live and where you take your equipment for servicing.

By the way, dampness and tobacco smoke are the two worst enemies your computer has. Neither is too good for us either! ■

BACK ISSUES

February 1986
HT accessories, more VIC-20 RAM, TR-2400 scanning, FT-101E RIT

March 1986
Wayne's back, extra FT-107 memories, speed dialer, digital IC trainer

April 1986
Stacked vee-beams, curved linear array, Dayton Hamvention, project potting

May 1986
Universal digital frequency display, hula hoop loop, W2NSD/1 on Lids

June 1986
Dirt cheap microwaves, 2 to 10, classic K2ORS humor

You'll also enjoy all of our regular features. Each back issue costs $3.50 plus $1.00 shipping and handling. On orders of 10 or more back issues, there is a flat $7.50 shipping and handling fee. Send your check or money order to 73, Attn: Back Issue Orders, WGE Center, Peterborough NH 03458-1194.

NEVER SAY DIE

from page 12

me, I'll drop your card like stink. Play it fair and square.

Remember, many of our advertisers are hams much like you—except they, in a weak moment, let themselves be talked into going into the ham business. Have pity. Read their ads—circle their numbers—read their literature and let your heart be your only guide. No ham worthy his salt lets his meager pocketbook slow him down. . . right? Remember, the one who dies with the most toys wins. Are you a winner?

A CONFLICT OF INTEREST

Packet radio is looking more and more like the next really big movement in amateur radio—the first since FM and repeaters 15 years ago. But packet has its promoters and its detractors, both with persuasive arguments.

On the plus side, packet requires little expense to be implemented—just your average ham transceiver, a computer, and a packet converter. You really should give it a try. Look over the packet ads in this issue and get cracking.

Okay, now to one of the major problems with packet radio—with the hope that you or your club can come up with some solutions. The FCC has two fundamental rules which they consider important. The first is that anyone transmitting on the ham bands should be licensed. The second is that the ham bands should not be used for commercial communications.

Both are concepts I think we can manage to live with, no matter how frustrating they may be to some amateurs. The problem with packet radio has to do with automatic relaying of messages, often with no record kept of traffic passing through. How can we then be sure that our system isn't used by non-licensed operators? And how can we keep commercialism at bay?

Sure, if relay stations checked out all relayed traffic, we'd have a pretty safe system. But as the volume of traffic passing through builds up, we know darned well that relay stations aren't going to bother reading all the mail. . . or even logging it. Given that inevitability, there will be little control over the use of our networks. Indeed, anyone with a home computer and an inexpensive two-meter rig (which anyone can own) could easily become a regular user with little likelihood of being noticed.

The security of being lost in a crowd would certainly tend to encourage some amateurs (or even non-amateurs) to step over the line of commercialization.

These are things to think over as packet grows in its popularity. The relay station handling a few dozen messages will have plenty of time to read the mail, but as it gets to thousands a day we're going to need some other system of checking.

One possibility might be to encourage relay stations to set up a separate computer just to keep track of relay traffic. They would then have a log of the number of messages handled, the calls originating them, the addressee calls, and the number of bytes relayed. By saving all traffic on a hard disk for a few days they would be able to check out traffic from newcomers to the net, frequent net user traffic, and so on. It isn't perfect, of course, but the knowledge that someone is likely to check out the traffic should act as a lid to discourage illegal use of the system.

The use of 8mm digital video tape to store relayed traffic would make a relatively inexpensive medium for mass storage. We're talking about around two gigabytes of storage per tape cassette. If we figure most messages will be less than one kilobyte, we'll have room for around a million messages per tape. That should hold even a busy relay station for a while.

A new digital audio tape technology is almost upon us—R-DAT, it's called. With this we'll have room for even more data than the 8mm video cassettes, yet they're much smaller than our regular audio cassettes. The 8mm cassettes are about the same size as audio cassettes.

Even our new picocomputers are coming with 3.5" disk drives built in these days. Modern technology allows us to put about one megabyte on these disks, with the promise of 15 megabytes soon. The permanent storing of all traffic shouldn't be a problem for long.

But this is something for our packet fanatics to think about and solve. What say you?

SO WAYNE'S BACK. . . SO?

Let's see, you may be interested in what happened at Orlando—where a lot happened. A whole lot, actually. Golly, where to start? Well, it was a big hamfest—bigger than Miami, I'll bet. Huge indoor flea market. Again, as at Miami, well over a thousand hams stopped by the *73* booth to welcome me back to the magazine. This made me and the whole staff feel good—thanks.

My return to *73*—and I've a bunch more to say about that—was pretty late for the Orlando hamfest to get the word out that I was on their program. I got some flack later on from disappointed hams who missed my talk through a lack of publicity from the hamfest committee. Being so late to get on the program, I had to settle for what they had left in time slots, which wasn't much, and almost no PR.

No, I'm not faulting Ed Huber, the show honcho, who did surprisingly well under very difficult circumstances. My own tendencies toward paranoia are difficult to ignore because every now and then someone leaks the information that "they" really *are* out to get me. For instance, at Orlando I was informed by Al that I'd have an hour and a half to talk, starting at 10 a.m. The show opened at 9, so I knew I'd miss maybe half or more of my possible audience who wouldn't even be there yet. I was not as pleased as you may think to find, on my arrival at a couple minutes to nine, that my talk had mysteriously been changed to 9. Since they didn't even open the doors so people could look it up in a program booklet until 9 a.m., I didn't expect much of a turnout. I was right.

Worse, when I went to the room for my talk, I discovered it had been changed to a different floor. By 9:30 I finally found myself outnumbered and started talking, pacing my talk for an hour instead of an hour and a half. About half way into my talk a chap stuck his head in the door and yelled to say I had to get out because he had the room at 10. Sigh. . . they've done it again!

I polled the small group who did find my talk and found that about a third of them were already active on packet radio. . . and another third were interested. Not exactly a cross-section of amateur radio, but more a cross-section of *73* readers. I'm aiming to have a good deal of information on packet. . . stay tuned.

Epcot

One of the big plusses of Orlando over Miami is the proximity of Disney World and Epcot Center. Since I've visited Disneyland in both Anaheim and Tokyo, I wanted to complete my Disney excursions. I got to the Orlando hamfest a day early and stayed a day late so I could do both Epcot and D World—which I did. No complaints as both were well worth the time.

One thing really disappointed me about the Disney complex—*no* ham activity. If there's any place in the U.S. where amateur radio should have a high profile, it's at Epcot. What a bummer! I met the ham involved with the Disney ham effort and found that he has had little support from the management so far. He mentioned a 7.03 repeater, but I was unable to raise it while there.

The next time I get to Washington I'm going to visit the Florida senators and explain the importance of amateur radio at Epcot. With their support I'll bet I'll be able to get to see the Disney management and explain the benefits to Epcot of having a first-rate ham station.

I talked with Kenwood, ICOM, and Yaesu about supporting a ham exhibit at Epcot and found them all most supportive. I don't know how many millions of people go through Epcot a year, but if the day I was there was typical, it's a bunch—about 50,000 a day. There were lines over a half hour long at the more interesting exhibits. The smart thing to do, as I figured out later, is to head for the country exhibits, which are toward the back end of Epcot and thus not jam packed right after opening time—then move toward the popular exhibits in the afternoon when the lines are short or even nonexistent. Live and learn.

Epcot is like a permanent world's fair. There are enough first-rate exhibits to keep you busy every minute for a complete day. If you sucker in on the long lines it'll take more than a day. You won't want to miss some of the interesting restaurants either. . . for instance, perhaps you've led a sheltered life and haven't ever eaten cous-cous, a Moroccan dish. You'll be able to give it a try while

you're in the Moroccan exhibit. Mmmm.

The 360-degree film in the Chinese exhibit is another must. Spectacular.

If you have any connections which might help us get a ham radio exhibit going at Epcot, please let me know. I'll bet this will take all the clout we can muster. We're going to have to emphasize the benefits to Epcot—how it will help attract the 415,000 hams and their families to the complex—how our advanced amateur radio technologies such as packet radio and OSCAR communications are just what Epcot is all about...people and the future. The Epcot managers should recognize that the key to the future IS communications, and the key to America's future lies in getting youngsters interested in self-education in electronics—just what amateur radio is really about.

The cost to Epcot need not be much more than their current budget. I'm sure we can get the ham industry to provide the equipment and get it installed. One good tech (which they already have on staff) is all that's needed to keep it going and to orient the visiting amateurs. The station operation can be done entirely by visitors. It might be possible to get a major firm as a sponsor, like we almost did with Coca Cola at the New York World's Fair a few years ago.

So, if you know anyone I should talk to about this, please don't make me ask twice. Drop me a note—tell them I'll be in touch—and we'll get moving with this.

Think about it—where else in the whole country is it more important to have amateur radio visible to the general public than at Epcot? And if you look at it from the Epcot view, American radio amateurs are precisely the demographic group they're looking for—middle income families on vacation. The hams will be taking back their Epcot/Disney World slides and videos to show their friends and neighbors.

Am I going to see you next March at Orlando? Will I be on the program? Will I get shafted? Tune in. Better yet, c'mon down! It's during spring vacation for the kids, so jump in your camper and see me before I self-destruct with enthusiasm for amateur radio.

CALL CORRECTION

Whoo, there are a lot of Don Miller hams! I've known three of 'em personally—one was the renowned DXer—the second was into SSTV and an ex-ARRL director—the third was a most interesting American ham living in Mexico City.

The DXer was W9WNV, not W9NTP. Someone mentioned that W9WNV committed suicide recently, but if so I missed hearing about it. I'd heard about him being in jail—something to do with hiring a chap to kill his wife. The SSTVer is W9NTP—my apologies for mixing the similar calls. SSTVer Miller has been going on the October Asian electronic show tours with me...probably why his call came to mind when I was writing about ex-DXer Miller.

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough, NH 03458-1194.

ACB 50TH
JUN 29–JUL 5

The ACB Radio Amateurs, a special-interest affiliate of the American Council of the Blind, will operate special-event station KW4U from 0000 UTC on June 29 until 2400 UTC on July 5 from the Hilton Hotel in Nashville, Tennessee, the sight of the ACB's silver anniversary convention. Operation will be 80 through 10 meters: 30 kHz from the bottom of CW bands; 5 kHz from the bottom of phone bands (±QRM). For a commemorative certificate, send a QSL to John McCann K4WU, 2105 W. Illinois Street, Arlington VA 22205.

WOODSTOCK 300TH
JUL 4

The Eastern Connecticut ARA will operate special-event station K1MUJ on July 4 from 8 a.m. to 5 p.m. EDT to celebrate the Woodstock, Connecticut, Tercentenary. Operation will be 80 through 10 meters: 40 kHz from the bottom of the CW bands, ±10 kHz from the center of the General phone bands, and packet (frequency and digipeater to be announced on W1AW BBS). Talk-in on 147.225/.825 or 146.52. For a commemorative certificate, send an SASE and QSL card to Tom Francis KB1SP, 73 Second Island Road, Webster MA 01570.

HARRISBURG PA
JUL 4

The Harrisburg RAC will hold its annual Firecracker Hamfest on July 4. Take Exit 1 off of Interstate 238 to Route 441 to the Bressler FC Picnic Grounds. Talk-in on .52. $3 admission. Tailgating free. Tables available. For more information, call Dave KC3MG at (717)-939-4957.

FORT LARAMIE
JUL 4–5

The High Plains ARC will operate special-event station K7YPT at Historic Fort Laramie from 0000 UTC July 4 until 0000 UTC July 5. Frequencies: phone—3.850, 7.250, 14.250, 21.360, and 28.550; CW—50 kHz up from the lower band edges. For a QSL, send a business-size SASE to K7YPT, PO Box T, Torrington WY 82240.

MILL DAYS
JUL 4–5

The Buzzard Roost Repeater Club will operate special-event station WB0UPK from 1500 UTC July 4 to 0100 UTC July 5. This event takes place at the Neligh Mills state historical site in conjunction with the Mill Days festival. Suggested operating frequencies: 3.950, 7.250, 14.295, 21.425, and 28.600 MHz. To obtain a QSL, send an SASE to WB0UPK, 804 East 1st Street, Neligh NE 68756.

SPIRIT FESTIVAL
JUL 4–5

The Heart of America RC and the Johnson County RAC will operate special-event stations from the Kansas City Spirit Festival on July 4–5, from 1800 to 0000 UTC both days, at the Soldiers and Sailors Liberty Memorial in Kansas City, Missouri. The station call for July 4th is W0RR; for July 5th it is W0ERH. Frequency is 7.225 MHz, phone only. Talk-in on 147.27/.87. Admission is $2. The public will be invited to operate the stations under club supervision, so Q-signals are discouraged. QSL via W0RR and W0ERH, PO Box 93, Shawnee Mission KS 66201.

WESTON WV
JUL 4–6

The 27th annual West Virginia State ARRL Convention will be held on July 4–6 at the Jackson's Mill State 4-H Camp near Weston, Lewis County, West Virginia. Free flea-market space for registrants. For more information, contact Sue Goodwin, 103 Cleveland Avenue, Nitro WV 25143.

MEADVILLE PA
JUL 5

The Crawford ARS will sponsor the Firecracker Hamfest on June 5, beginning at 8 a.m., at the Meadville Recreation Center, just off Route 27 E in Meadville, Pennsylvania. Admission is $2; children are free. Swimming costs extra (two pools). Indoor flea-market space is free—bring your own table. Talk-in on 144.53/145.13. For more information, write CARS Hamfest '86, PO Box 653, Meadville PA 16335, or call Ben Ferer KF3F at (814)-724-2432.

TOM SAWYER DAYS
JUL 5–6

The Hannibal (MO) ARC will operate special-event station W0KEM from the Tom Sawyer Days celebration on July 5–6, from 1500 to 2100 UTC both days. Frequencies: phone—7.245, 14.290, 21.400, and 28.770; CW—7.125 and 21.125. For a certificate, send a 9 x 12 SASE and QSL to W0KEM, RR 1, Box 55A, Payson IL 62360.

DOUGLAS WY
JUL 11–13

The Wyoming Hamfest will be held on July 11–13 at the Wyoming State Fairgrounds, Douglas, Wyoming. Amateur exams will be given. For more information, Send an SASE to 1986 Wyoming Ham-

fest, PO Box 3842, Gillette WY 82716-0390.

SAN ANTONIO TX
JUL 11–13

The Texas State ARRL and Texas VHF/FM Society joint convention will take place at the El Tropicano Hotel on July 11–13, beginning at 6 p.m. Friday, from 8 a.m. to 5 p.m. Saturday, and from 9 a.m. to 12 p.m. Sunday. ARRL forum, amateur swap, dealer/manufacturer displays, and preregistered license exams. Convention registration: $5 advance, $7 at door, family $2 advance, $3 at door. Amateur swap tables $5. Talk-in on 148.66 simplex. Send advance reservations to PO Box 18506, San Antonio TX 78218; (512)-698-1712 or 698-0560. Include an SASE for return confirmations. For more information, contact Melvin H. Anderson, Jr. WB5NOL, 8932 Saddle Trail, San Antonio TX 78255; (512)-698-1712 or 698-1714.

PLEASANT GAP PA
JUL 12

The Nittany ARC will hold its annual Mt. Nittany Ham Festival July 12 from 8 a.m. to 4 p.m. at the Firemen's Carnival Grounds in Pleasant Gap, Pennsylvania, 10 miles north of State College off Route 26. Admission is $3 per ham or $5 for flea-market space. Spouses and children free. Talk-in on 146.16/.76 from the north and west; 146.25/.85 from the south and east, and 146.52. For further information, contact Chuck McMullen K3CM, 7 Holly Circle, State College PA 16801.

PETOSKEY MI
JUL 12

The Straits Area ARC will hold a computer demonstration and swap and shop on July 12, from 9 a.m. to 2 p.m., at the Petoskey, Michigan, Fairgrounds. $2.50 donation at the door. Eight-foot table, $3. Splits allowed. Talk-in on .52 and .07/.67. For more information, contact Irene Stein N8HBT or Joe Werden WD8MJB at 4487 Robinson, Pellston MI 49769; (616)-347-8693.

EAU CLAIRE WI
JUL 12

The Eau Claire ARC will hold its annual hamfest on July 12, from 8 a.m. to 4 p.m., at the 4-H Buildings in Eau Claire, Wisconsin. Tickets are $3. For more information, send an SASE to Gene Lieberg KA9DWH, 2840 Saturn Avenue, Eau Claire WI 54703.

OAK CREEK WI
JUL 12

The South Milwaukee ARC will hold its annual swapfest on July 12 at American Legion Post 434, 9327 South Shepard Avenue, Oak Creek, Wisconsin, from about 7 a.m. to about 4 p.m. Amateur-radio exams will be conducted during the day by the Milwaukee Volunteer Core Group. Admission is $3. Talk-in on 146.94 MHz. For further information, including map, write the South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102.

POUGHKEEPSIE NY
JUL 12

The Mt. Beacon Hamfest will be on July 12, from 8 a.m. to 3 p.m. (sellers 7 a.m., auction 2 p.m.), at the Arlington Senior High School, Poughkeepsie/Lagrange, Dutchess County, New York. Big indoor flea market. Admission: $3 (hams and computer hobbyists); $4 with tailgating space; $6 with one free table. Talk-in on 146.37/.97 and 146.52 simplex. For further information, contact Julius Jones W2IHY, RR 2, Vanessa Lane, Staatsburg NY 12580; (914)-889-4933.

MAPLE RIDGE BC
JUL 12–13

The Maple Ridge ARC will sponsor the Maple Ridge Hamfest on July 12–13 at St. Patrick's Center, 22589 121st Avenue, Maple Ridge, British Columbia. Admission is $6, $3 for non-hams over 12, under 12 free, $9 for two hams in a family. Talk-in on 146.20/.80 and 146.34/.94. For more information, contact Bob Haughton VE7BZH, Box 292, Maple Ridge, British Columbia V2X 7G2, Canada; (604)-467-4915.

TEXAS 150TH
JUL 12–13

Special-event station W5SC will be operated from the Texas ARRL and VHF/FM Society convention to commemorate 150 years of Texas independence. Operation will be from 1200 UTC to 0400 UTC on July 12, and from 1200 UTC to 1800 UTC on July 13. Use the lower portions of the 10-, 15-, and 20-meter General CW and phone bands. Send a QSL and an SASE to W5SC, 90 Brees Boulevard, San Antonio TX 78209. For more information, call Andy Anderson WB5NOL at (512)-698-1712.

INDIANAPOLIS IN
JUL 12–13

The IARA will sponsor the 16th annual Indiana ARRL Convention and Indianapolis Hamfest on the weekend of July 12 and 13, at the Marion County Fairgrounds, Indianapolis, Indiana, opening at 6 a.m. each day. Gate admission is $5, with free parking, including overnight camper hookups and facilities. Inside tables are $8. ARRL and technical forums, home-brew display contest, QSL card contest (judging best personal and best-received cards), 2m fox hunt Saturday, 450m fox hunt Sunday. For further information, call Bill Evans WB9BEN at (317)-745-6389.

N. DAKOTA/MANITOBA
JUL 12–13

The 23rd International Hamfest and Computerfest will be held July 12 and 13 at the International Peace Garden between Dunseith, North Dakota, and Boissevain, Manitoba, Canada. Activities include transmitter hunts, mobile judging, and CW contests. Talk-in on .52 simplex. For further information, write MARA, Box 64, Minot ND 58702.

BSA CAMPOREE
JUL 12–20

Scout and Scouters from all over the world, with the assistance of the Southern Connecticut ARA and the Camp Sequassen Alumni Association, will operate a special-event station from the Boy Scouts of America Connecticut International Camporee. The station will be operated July 12–20 from 8 a.m. to 10 p.m. daily. Frequencies: phone—3.940, 7.290, 14.290, 21.360, and 28.990; CW—3.725 and 7.125. Send a QSL and an SASE to the Camp Sequassen Alumni Association, c/o Al Schwartz KA1CFA, 18 Russo Drive, Hamden CT 06518.

BOWLING GREEN OH
JUL 13

The Wood County (Ohio) ARC will sponsor the 22nd annual Ham-A-Rama on July 13 at the Wood County Fairgrounds, Bowling Green, Ohio. Admission is free. Talk-in on 147.18/.78 and 146.52. For more information, contact Chuck Dicken WD8ICP, 1002 Revere Drive, Bowling Green OH 43402; (419)-352-0865.

DOWNERS GROVE IL
JUL 13

The DuPage ARC is sponsoring a hamfest/computerfest on July 13, beginning at 8 a.m., at American Legion Post 80, 4000 Saratoga, Downers Grove, Illinois. Admission is $3 at the gate, $2 in advance. Indoor tables available. VEC exams for all classes. Talk-in on 146.52 simplex. For tickets or reserved tables, send an SASE to: Hamfest Chairman W9DUP, PO Box 71, Clarendon Hills IL 60514; or call (312)-985-0527 evenings and weekends.

WATERTON ALTA
JUL 18–20

The 52nd Glacier-Waterton International Hamfest will be held on July 18–20 at the Waterton Homestead Campground, just north of the Waterton National Park entrance on Highway 6, Alberta, Canada. For more information, write to PO Box 148, Milk River, Alberta T0K 1M0, Canada.

AUGUSTA NJ
JUL 19

The Sussex County ARC will sponsor SCARC '86 on July 19, beginning at 8 a.m., at the Sussex County Fairgrounds, Plains Road, off Route 206, Augusta, New Jersey. Admission is $3. Indoor tables are $7; tailgating space is $5. Talk-in on 147.90/.30 and 146.52. For more information, contact Donald R. Stickle K2OX, Weldon Road, RD#4, Lake Hopatcong NJ 07849; (201)-663-0677.

ATLANTA GA
JUL 19–20

The Atlanta Radio Club will sponsor the 1986 Atlanta HamFestival on July 19–20 at the Georgia World Congress Center, Atlanta, Georgia. Features include over 150 exhibitors and an air-conditioned flea market. For more information, send an SASE to the Atlanta HamFestival, Inc., PO Box 77171, Atlanta GA 30357.

YACHT RACE
JUL 19–20

The Eastern Michigan ARC will operate special-event station K8EPV on July 19–20, from 1400 UTC to 0200 UTC both days, during the annual Port Huron to Macinac Island yacht race. Frequencies: SSB—3.870, 7.235, 14.235; CW—3.710 and 7.110. For a multi-color QSL, send an SASE to C.B.A., 654 Georgia, Marysville MI 48040.

DES MOINES IA
JUL 19–20

The Des Moines RAA will hold the Iowa State Convention from 8 a.m. to 6 p.m. on July 19 and from 8 a.m. to 3 p.m. on July 20. Admission is $3 in advance, $4 at the door. Talk-in on 146.34/.94, 444.50, or 146.22/.82. For more information, write to DMRAA, PO Box 88, Des Moines IA 50301.

WHEELING WV
JUL 20

The Triple State RAC will hold its 8th annual Wheeling Hamfest/Computer Fair on July 20 at Wheeling Park, from 9 a.m. to 4 p.m., rain or shine. Admission is $3 in advance, $4 at door. Talk-in on 146.31/.91. To reserve space, contact Jay Paulovicks KD8GL, RD 3, Box 238, Wheeling WV 26003; (304)-232-6797. For tickets, contact TSRAC, Box 240 RD 1, Adena OH 43901; (614)-546-3930.

WASHINGTON MO
JUL 20

The Zero-Beaters ARC will hold its 24th annual hamfest on July 20, from 8 a.m. to 3 p.m., at Bernie H. Hillerman Park, Washington Fairgrounds, Washington, Missouri. Free flea-market space is available. License exams will be given. Talk-in on 147.84/.24 and .52. For more information, contact the Zero-Beaters ARC, Box 24, Dutzow MO 63342; (314)-239-2072.

FLAT HAMMOCK ISLAND
JUL 20

The Tri-City ARC will operate expedition station KA1BB on July 20, from 1300 to 2000 UTC, from Flat Hammock Island in Fisher Island Sound, New York. This will be only the third time that there has been HF operation from this island. Operation will be in the lower 20 kHz of the phone and CW portions of the 15-, 20-, and 40-meter General-class bands, as well as the center of the 40-meter Novice band. Send a QSL and an SASE to Tri-City ARC, PO Box 686, Groton CT 06340. For more information, contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016.

SPACEFLIGHT 25TH
JUL 20–21

The Illinois Valley ARC will operate special-event station KD9UL from 1300 UTC July 20 to 0100 UTC on July 21 to commemorate the 25th anniversary of manned spaceflight—in conjunction with Spaceweek. Frequencies: phone—the bottom 25 kHz of the General phone bands; CW—the bottom 20 kHz of the Novice bands. For a QSL and a certificate, send your QSL and an SASE to Bruce Boston KD9UL, 815 East Third Street, Beardstown IL 62618.

RIVERCADE
JUL 23–27

The Sooland ARA will operate a special-event station on July 23–27, from 5 p.m. to 10 p.m. CDT daily, from the riverfront at the annual Port of Sioux City Rivercade. Operation will be on 14.285 MHz ±10 kHz. Operators will use their own calls but will add "Rivercade" to all CQs and contacts. To receive a certificate, send your contact number and a 9" SASE to Loren Barbee WB0YOW, 1015 16th Street, Sioux City IA 51105.

BIX BIEDERBECK JAZZ FESTIVAL
JUL 25–27

The Davenport Radio Amateur Club will operate special-event station W0BXR during the Bix Biederbeck Memorial Jazz Festival. Times of operation are: July 25, 1700–2200 UTC; July 26, 1500–2300 UTC; July 27, 1600–2200 UTC. Operation will be 80–10 meters, phone and CW, 10 kHz up from the lower end of the General-class bands. For a certificate, send a QSL and an SASE to the Davenport RAC, 2131 Myrtle Street, Davenport IA 52804.

RENTON WA
JUL 25–27

The Western Washington DX Club will host the 34th annual Pacific Northwest DX Convention on July 25, 26, and 27 at the Sheraton Hotel in Renton, Washington. Activities for the DXer and contester; a presentation from Bob Winters KD7P/KH4, recently returned from his Wake Island operation; and a tour of ICOM America, Inc., corporate HQ are included. Tickets purchased before July 1 for all activities are $38 ($42.50 at the door); for programs and banquet, $33; for programs only, $13. For further information, contact Andrew Isar NN7L, Convention Chairman, PO Box 224, Mercer Island WA 98040; (206)-467-1277.

STEAM AND GAS
JUL 26–27

The Pike County ARC will operate special-event station W9CHZ, from 1700 UTC on July 26 until 1700 UTC on July 27, from the 23rd reunion and show of the Antique Steam and Gas Engine Club. Operation will be in the low end of the 75-, 40-, and 15-meter General-class bands, phone and CW. There will also be operation in the 40-meter Novice band on July 26 from 2000–2330 UTC. For an 8 x 10 certificate, send a QSL and an SASE to PCARC, RR1 Box 311, Winslow IN 47598.

W. FRIENDSHIP MD
JUL 27

The Baltimore Radio Amateur Television Society (BRATS) will present the Maryland Hamfest and Computerfest on July 27 at the Howard County Fairgrounds, Rte. 144 at Rte. 32, adjacent to Interstate 70, in West Friendship, Maryland, beginning at 6 a.m. (dealer setups begin Saturday at 2 p.m.—overnight security provided). Tailgating space available for $4; advance reservations required for tables: indoor along the wall with ac outlets, $20 each or 4 for $75; without ac, $10 each or 10 for $95. Free VE exams at 11 a.m., no advance registration required. Talk-in on .63/.03, .16/.76, and .52. For reservations and further information, contact Mayer Zimmerman W3GXK, BRATS, PO Box 5915, Baltimore MD 21208; (301)-655-7812.

HAYS KS
JUL 27

The Hays ARC will hold a swapfest and auction on July 27, from 9 a.m. to 5 p.m., at the Sheridan Coliseum, Fort Hays State University, Hays, Kansas. Admission is $2, tables $1. Activities include VE testing, packet, OSCAR, ATV, video tapes, and fox hunting. Talk-in on 147.78/.18. For more information and reservations, contact Andy Oldham N0EBS, 117 N. 8th St., Wakeeney KS 67672; (913)-743-2712.

OHIO STATE FAIR
AUG 1–17

The Columbus ARA will be operating special-event station W8TO on August 1–17 to promote the Ohio State Fair. Operation will be on 80 through 10 meters. Times and frequencies to be determined by persons manning the booth at the fair (11 a.m. to 9 p.m. EDT daily). A valid exchange includes name, QTH, and RST. For a commemorative certificate, send a log extract or QSL card and an SASE to W8TO, Attn: State Fair Event Coordinator, 280 East Broad St., Columbus OH 43215.

PRO-FOOTBALL WEEKEND
AUG 2–3

The Canton ARC will operate special-event station W8AL to celebrate the Pro-Football Hall of Fame's Greatest Weekend on August 2–3, from 1700 to 2200 UTC each day. Operating frequencies will be: SSB—14.270 and 7.270; CW—14.060 and 7.060. For a special H.O.F. QSL card, send your card with an SASE to Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710.

ANGOLA IN
AUG 3

The Steuben County RA will present their 28th annual FM Picnic and Hamfest at Crooked Lake, Angola, Indiana, on August 3. Two miles north of Angola, I-69 to Crooked Lake exit. Admission is $2.50. Inside tables for exhibitors and vendors available. Talk-in on 146.52 and 147.81/.21.

BERRYVILLE VA
AUG 3

The Shenandoah Valley ARC will sponsor its 36th annual Winchester Hamfest on August 3, from 7 a.m. to 3 p.m., at the Clarke County Ruritan Fairgrounds on Route 7, two miles west of Berryville, Virginia. Admission is $4, women and children under 12 are free. Tailgaters and limited tables $5. Talk-in on 146.22/.82 and 146.52 simplex. For further information, call Rob Kinsley NT4S at (703)-869-5113, or write SVARC at PO Box 139, Winchester VA 22601. Exams on August 2 at 9 a.m.—call Walt Quitter NC4B at (703)-869-5241, or send an SASE to 367 Buckingham Drive, Stephens City VA 22655.

WEST MIFFLIN PA
AUG 3

The South Hills Brass Pounders and Modulators ARC will hold its 49th annual hamfest on August 3 at the south campus of Allegheny Community College, located in West Mifflin, Pennsylvania, about seven miles south of Pittsburgh. Talk-in on 146.13/.73 and 146.52. For further information, contact Doug Wilson WA3ZNP, 185 Orchard Avenue, Emsworth PA 15202; (412)-761-1851.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards or odd-sized scraps of paper. Please type or print your request (neatly!, double-spaced, on an 8-1/2 x 11 sheet of paper and use upper- and lower-case letters where appropriate). Also, please make a 1 look like a 1 not an l—which could be an el or an eye, and so on. Hard as it may be to believe, we are not familiar with every piece of equipment ever manufactured on Earth! Thanks for your cooperation.

I'm looking for the operating and service manual, including the schematic, for an Standart ACS 176 made by Weston Instruments, Inc., in Lexington MA. Will pay for any costs incurred.

J.F. Picard F6ERK
5 Place de L'Etolle
91330 Yerres France

Atari-XL hams! Some DLs, like me, are searching for any RTTY and HAM programs. For your help, I can offer you AMSAT-DL's OSCAR package, which is based on the Atari-XL microcomputer and provides packet radio communication via the projected DLSAT-OSCAR as well as via OSCAR-10.

Matthias Beier DD4WW/A
Keithstr 36 Ap 818
1000 Berlin 30
West Germany

I need the name of the magazine, including month and year, that ran an article on secure repeater control.

Peter Rowe VE3EQA
222 Westmount Drive S.
Orillia Ontario Canada L3V 6E4

I need a workable or repairable scope capable of a scan rate of 50mm/sec or less. A hospital EKG scope would do nicely.

Ira Linderman WB2RXR
PO Box 229
Commack NY 11725

I need documentation/info for a Pathcom/Pace Communicator II 2-meter FM rig (Pathcom has no information on file); a Measurements model 80 signal generator and any FMing mods and parts; Santec HT-1200 mods, commercial uses, etc.; and sim-patch circuits. Will compensate for copying and/or postage. Contact via phone or The Source (AAJ696), or mail direct.

Jim Aspinwall WB9GVF/5
3046 Creekband Circle
Grapevine TX 76051-6311
(817)-481-6311

I am looking for amateurs who purchased TET Antenna Systems of the HB9CV series. I have the model HB43SP, which works well on 10 and 20 meters but poorly on 15 meters. I have tried to make adjustments as stated in instruction, but these only resulted in a 50-kHz-wide vswr curve. Can any TET owner help? Also, is the TET being made now? If so, where, and by whom (address)?

Dale McMindes KA4HBW/V2A
VOA Box 19
FPO Miami FL 34054

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RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

A few months ago, I wrote about the trials and tribulations of a reader who wanted to put a TRS-80 Model 100 computer onto RTTY. At the time, I said that I had no helpful information available. Well, thanks to some others in the fraternity (non-sexist, of course), we have an answer.

Phil W6TUH passed along his thoughts on Model 100 RTTY through CompuServe. He said that he is using his Model 100 with an HF rig (Kenwood TS-520S) via a Kantronics UTU (Universal Terminal Unit). It is easy to set up and works well. The cost is about $200 and *no* software is needed; all software to support RTTY, CW, AMTOR, and ASCII is ROM-resident in the UTU. The unit connects to the Model 100 RS-232 port (STAT=38l1E,10) and to the rig from the external speaker and mike connectors (AFSK)—and can support FSK, as well.

Although he's been at it for 31 years, Phil says that he's not a gung ho ham. But, even though the UTU may not give the ultimate RTTY station, it will work with any computer that can support a dumb-terminal mode and has RS-232 with the required (fairly standard) communications parameters. Phil hasn't used it on VHF, but it appears that connection to a 2-meter rig would be simple.

Phil adds an important caveat: Unless your rig has a special RTTY mode, reduce the dc input to 30–50% of CW value, since duty cycle is 100% on RTTY; otherwise, kiss your finals goodbye!

David Wolovitz WA3DNM of Media, Pennsylvania, sent me some E-mail on CompuServe informing me of a piece of software called RTTY.100 that's available on the Model 100 SIG. Written by Steve Alverson WB8HRV, this is a "mostly BASIC" program that enables the Model 100 to be used as a RTTY terminal.

Steve writes that the program is designed to allow the Model 100 to transmit and receive Baudot (Murray) 5-level RTTY code. Speeds of 60, 66, 75, and 100 wpm are supported. Both received and transmitted text can be echoed to a printer, and the RTS control line can be used for transmitter control.

```
1 GOTO 100
2 REM RTTY terminal emulator - 09/24/85 Steve Alverson WB8HRV
  75236,341
5 F=0:OUT186,INP(186)AND127:PRINT:PRINT"Receiving":IFPTHENLPRINT
10 IFTTHEN60ELSECALLVARPTR(ML(0)),0,VARPTR(X(0)):IFX(0)=0THENGOTO10
   ELSEIFX(1)>31THENGOTO10
20 IFX(1)=0THENGOTO10
25 IFX(1)=27THENF=-1:GOTO10
30 IFX(1)=31THENF=0:GOTO10
35 IFX(1)=4THENF=0
40 IFPTHENR$=MID$(P$,X(1)+1,1)ELSER$=MID$(LS,X(1)+1,1)
45 CALL19268,ASC(R$):IFPTHENCALL27967,ASC(R$)
50 GOTO10
60 F=0:OUT186,INP(186)OR128:PRINT:PRINT"Transmitting":IFPTHENLPRINT
70 IFNOT(T)THEN5
72 S$=INKEY$:IFS$<>""THEN70ELSECALLVARPTR(ML(9)),ASC(S$),VARPTR(S)
80 S=INSTR(2,L$,CHR$(S)):IFS=0THEN90ELSES=S-1
85 IFPTHENCALL28210,31:F=0
87 CALL28210,S:PRINTS$;:GOTO70
90 S=INSTR(2,P$,S$):IFS=0THENBEEP:GOTO70ELSES=S-1
95 IFNOT(F)THENCALL28210,27:F=-1
97 CALL28210,S:PRINTS$;:GOTO70
100 DEFINT A-Z:DIM L$(31),P$(31),ML%(11),X(1)
110 L$=" E"+CHR$(10)+"A SIU"+CHR$(13)+"DRJNFCKTZLWHYPQOBG MXV"
120 P$=" 3"+CHR$(10)+"_ "+CHR$(7)+"87"+CHR$(13)+"$4',!:(5"+CHR$(34)+
    "}2#601928 ./;"
130 A=0:F=0:T=0:S=0:FOR1=0TO11:READML(I):NEXTI
140 CALL 16969
150 OPEN "COM:28N1D" FOR INPUT AS 1
160 OUT186,37:OUT216,5:OUT188,52:OUT189,77:OUT184,195
165 POKE65421,31
170 ON KEY GOSUB 200,210,220,230,260,240,250,300
175 KEY ON
180 GOTO 5
200 OUT188,52:OUT189,77:OUT184,195:RETURN
210 OUT188,0:OUT189,76:OUT184,195:RETURN
220 OUT188,139:OUT189,74:OUT184,195:RETURN
230 OUT188,22:OUT189,72:OUT184,195:RETURN
240 F=0:PRINT:IFPTHENLPRINT
245 RETURN
250 IFPTHENP=0ELSEIF(INP(187)AND6)<>2THENPRINT"LST not ready!":ELSEP=1
255 IFPTHENPRINT"Echo on":RETURN:ELSEPRINT"Echo off":RETURN
260 T=NOT(T):RETURN
300 MENU
400 DATA 54,28109,-14227,9012,35,32461,30573,13859,-14080,-13056,4073,
    -13961
```

Program listing 1. RTTY.100.

This program uses the RS-232 port. It requires an external TU (terminal unit) to first convert the receiver audio into RS-232 levels, and then convert it back into tones for transmission. Steve uses a Flesher Corp. TU-300, but any TU with RS-232-compatible signal levels should work. Note that the TU-300 does *not* support RS-232 transmit control—external circuitry is required.

Program Operation

The program begins in receive mode at 60 wpm with echo to printer disabled. Function keys F1 through F4 set the speed to 60, 66, 75, and 100 wpm, respectively. F5 toggles in and out of transmit, F6 sets letters mode and starts a new line, F7 toggles the echo to printer mode, and F8 returns to Menu.

The buffer stores about 30 characters in receive mode, and will transmit them as soon as you select transmit. If you type any character that does not exist in Baudot, you get beeped and nothing is sent. Letters may be typed in upper- or lowercase: They are converted to uppercase before transmission, but are echoed in lowercase (also to the printer, if enabled). This could be useful to differentiate received from transmitted text on a printout.

Steve adds that if he understood more about the LABEL line, he would allow the LABEL key to toggle the last line with a description of the function keys. Any takers??

Machine-Language Calls

Several machine-language calls are used in this program. For those who are interested but who do not have access to references, they are listed below:

16969 (4249H)—Turns on the cursor

19268 (4B44H)—Prints the character in the A reg onto the LCD

27967 (6D3FH)—Prints the character in the A reg onto the LST

28210 (6E32H)—Sends the character in the A reg to the RS-232 port

In addition, a machine-language routine is read into array ML. The entry point at ML(0) checks for received characters. If none are present, it returns with X(0) = 0. If a character has been received, X(0) = 1 and the character is in X(1). The entry at ML(9) converts the character in the A register to uppercase, and places it in the variable pointed to by HL. This allows transmitted text to be typed in lowercase and automatically converted to uppercase (Baudot has no lowercase).

The program itself, RTTY.100, can be downloaded from the Model 100 SIG on CompuServe or, for brave souls with sturdy typing fingers, can be typed in from Program listing 1. Good luck, all, and let me know how it goes. My thanks, again, to Phil, David, and Steve, for all the help and information.

Turning to some paper mail, I have a letter here from Edward Kotz NGØR of Roggen, Colorado. He tells me that he has a second-hand, kit-built HAL ST-5 demodulator and would like to interface it to an RS-232 port for his IBM-compatible NCR PC-6 computer. He wrote to HAL but they said, "The ST-5 was not meant to be used with a computer. . . best solution. . . PCI-2000." No kidding! It seems to him that the price tag is about $600 or more. He wonders if the modification could not be done using optoisolators, relays, or the like.

Well, Edward, I sympathize with you in the amount of information received in response to your request. I have been less than successful in obtaining information from most manufacturers I contact. In the case of the ST-5, I think I have good news for you.

An "FSK" output is available at pin 3 of jack J2 of the constructed ST-5. According to specs, output from this terminal is −15 V on mark and +15 V on space. Sound familiar? You got it, that meets RS-232 specs nicely. Now, in order to get this output, all you should have to do is complete the loop, with a resistor if needed. And that's it!

Now, if you have an ST-5 built from boards, without the "standard" output plugs, you will find the "FSK" output on the power-supply board at a hole between the bodies of R106 (a 8.2k, 1-Watt resistor) and D105 (a 1N4005 diode). Don't forget to close the loop, even if you don't use a conventional RTTY machine. I look forward to hearing how well you do.

Another regular reader, Peter NH6BF/KA6BF/7J6CAG (whew!), says he got onto RTTY with a Heathkit 151, another IBM-compatible computer. He is using KF4NB's software and is having a blast with it. He relates that the major differences between his old CoCo and the Heath setup are disk access, enhanced memory

for traffic, 80-column display, and more bells and whistles throughout. The only problem he says he has is more noise generated by the Heath than the CoCo (ha!).

For further information to the gang, Peter passes along his review of some of the hardware he has used. He feels that the MFJ-1224 interface copies better than an old Kantronics "The Interface," but doesn't stand its ground next to an AEA CP-1 or TONO. The MFJ, he says, requires an S-9 signal for perfect copy, which he needs for volume traffic handling, whereas the AEA copies an S-2. I, for one, would be interested in others' observations and comparisons of these units.

Peter also notes that he has seen a disk-based program for the CoCo that had all kinds of features, like buffers from a disk file, selcal, saving the received information to disk, and disk file transmit. He thinks it was called RTTY64, but he cannot put his hands on the program. Does anyone out there know about this program and where it has been hiding? Tell me, tell me, folks. Let's not keep a good thing secret!

Sometimes I get letters that I just don't know how to answer. Joseph Lerch, Jr. KC3GV writes that he recently purchased an Apple IIc system, and wants to get it onto RTTY. He notes that the IIc does not have a game paddle I/O port, which makes interfacing it more difficult than other Apple IIs. Apparently he has had little luck finding out anything from those around him whom he has contacted. Any of y'all have any suggestions? Pass them along, and I'll forward what I can.

The toughest question he asks, though, is the last one in the letter. He says, "Would you say I made the best choice, or is there a better setup? I can't afford a Commodore, too, and we needed the Apple." I don't know that there is a "best" setup, Joseph. The bottom line has always been what you are using the computer for. If only for RTTY, an inexpensive C-64 or CoCo may well be all that you need. But, if you need an Apple to use other programs, then by all means, buy the Apple. Ditto if you need a PC compatible. You see, there is no easy answer and, when all is said and done, you may not even be happy with one computer for all purposes. The statement may be trite, but "you pays your money and takes your choice!"

On and off, for the last year or so, I have been asking you all what you thought about packet-radio coverage in this column. Reaction has been kind of mixed, so I am pleased to welcome fellow columnist Harold Price NK6K to the pages of *73*, where he has begun writing a column specifically devoted to packet. I know that this is an exciting vanguard area in amateur radio, and I hope that those of you who are experimenting with packet will keep both Harold and me posted on your efforts.

As for me, I continue to hang around here and there, and may even have a new skyhook up by the time this reaches print. If only I can get the bow and arrow working! Of course, I welcome your questions by mail, as well as by E-mail, via my CompuServe ppn 75036,2501. More than a few of you have expressed interest in a feeler I put out regarding a RTTY program for the CoCo. I will continue to play with the idea, and publish what I can right here in RTTY Loop.■

QRP

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YOU CAN TAKE IT WITH YOU

When vacation time comes around, the OM would like to stay home, operate his radio station, and experiment with antennas. He has had his nose to the grindstone all year and has had little or no time for his favorite hobby. However, his wife is tired of being at home all of the time and would like to have a vacation in the beautiful mountains of Colorado. The kids would also like to go away for a week or two. This family problem *can* have a happy solution! The OM can take a small radio station with him.

Instead of going to the Broadmoor Hotel in Colorado Springs, the family can (for much less money) rent a comfortable cabin in north of Estes Park. With the money thus saved, equipment for a good QRP battery-operated station can be purchased. This is one way of getting money for buying equipment. There is the old saying: Where there is a will, there is a way! If family finances are tight, perhaps a friend will lend the OM a small transceiver for use on the vacation.

What will the OM need for his portable station? In addition to the small transceiver, he will need a power supply and an antenna system. A Ten-Tec Argosy or Argonaut transceiver would be an excellent choice. The Argosy has a switch that shows forward rf power in one position and reflected rf power in its other position. This switch eliminates the need for an swr meter when you use an antenna tuner.

Heathkit QRP transceivers also could be used. The HW-7, 8, and 9 are all usable. The HW-9 is the best of the three because it has a superheterodyne receiver and a bit more power output.

For the power supply, a 12-volt motorcycle battery and an inexpensive battery charger will do the job nicely.

A new Ten-Tec Argosy transceiver without a power supply costs from $600 to $700, depending on how many CW filters or other "extras" are ordered. Used transceivers can be obtained for somewhat less. The Heathkit HW-9, in kit form, sells for around $250 (plus whatever extras are desired). For the power supply, a 12-volt motorcycle battery costs from $25 to $30 and can be kept charged using a small $10 battery charger.

There are several kinds of antenna systems that can be used. A lightweight, easy-to-put-up pole that will knock down into four- or five-foot lengths should be obtained. A telescoping 20-foot fiberglass fishing pole would be ideal for the top part of the pole. Such a pole should be capable of holding up the center of a wire antenna. Although more poles could be used, a single pole will do nicely to hold up the center of an inverted-vee antenna system. Naturally, the taller the pole, the better. Using a pole made of fiberglass or other insulating material is desirable so that a vertical antenna for 20 meters or a higher frequency band could be taped to the pole.

Endfed antennas do not have heavy feedlines and can be made out of lightweight wire. Endfed wire antennas also will work on two or more bands. Of course, an antenna tuner must be used with any endfed antenna. However, if the antenna is a resonant length for the band or bands to be used, a small tuner consisting of a parallel tuned coil can be constructed easily from parts found in a junk box. For a list of resonant length wires, see Table 1. For quarter-wavelength wires for a grounding system, see Table 2.

When you're using an endfed antenna, it is desirable (if not absolutely necessary) to have a quarter-wavelength wire for each band to be used connected to the ground post of the antenna tuner. These wires are sometimes called radials and they can take the place of a ground when it is difficult to get a good ground. These

80 meters—66 feet
40 meters—33 feet
30 meters—23 feet
20 meters—16-1/2 feet
15 meters—11 feet
10 meters—8-1/2 feet

Table 1. Resonant lengths of wire.

135 feet is resonant on the 80-, 40-, 20-, 15-, and 10-meter bands
67 feet is resonant on the 40-, 20-, 15-, and 10-meter bands
46 ft., 2 in. is resonant on the 30-meter band
33 feet is resonant on the 20- and 10-meter bands
22 feet is resonant on the 15-meter band
18 feet is resonant on the 10-meter band (low frequency end)

Table 2. Lengths of quarter-wavelength ground "radial" wires.

RESONANT LENGTHS

A 135-foot wire is resonant on harmonically related bands as follows:
On 80 meters (3.5 MHz) it is a half-wavelength dipole
On 40 meters (7 MHz) it is a one-wavelength dipole
On 20 meters (14 MHz) it is a two-wavelength dipole
On 15 meters (21 MHZ) it is a three-wavelength dipole
On 10 meters (28 MHz) it is a four-wavelength dipole

If you add 5 feet more to one end of the 135-foot wire, it will become a 3/2-wavelength resonant wire for the 30-meter (10.1-MHz) band.

Of course, if the antenna tuner is one which will load up random lengths of wire, the length of the antenna wire can be any "reasonable" length that is at least a quarter-wavelength long for the lowest band to be used. Wires 1/2 to 3/4 wavelengths long at the frequency being used radiate at right angles to the antenna. Wires one wavelength or longer at the frequency being used radiate in a four-leafed-clover directional pattern. However, an inverted-vee configuration will send fairly well in all directions.

wires can be cabled together and run along the baseboard inside the cabin, or go out through the door under the bottom hinge. For an out-of-doors station, the wires can be laid on the ground.

There probably is no need to have a 15-meter radial wire since the 40-meter wire is 3/4 of a wavelength for 15 meters—an odd number of quarter wavelengths. For an excellent discussion of ground radials, see *Simple Low-Cost Wire Antennas for Radio Amateurs* by William I. Orr W6SAI and Stuart D. Cowan W2LX (Chapter 8, "The End Fed, Multi-Band Antenna," pp. 95–98).

It is a good idea to use well-insulated wire for vacation antennas rather than wire that has only enamel for insulation. Well-insulated wire can go out of a building under a window or through a door near a hinge.



Photo A. Pole supporting the fishing rod is lashed to the porch railing.

In a typical cabin, a small table can be placed near a door or window. It can hold the transceiver, the swr meter (if any), the antenna tuner, the telegraph key (or paddle and keyer), the log book, paper, and pen or pencil. The wire from the antenna tuner could go through the door above the top hinge or out under a window, up to the top of the antenna pole, and out and down to a rope tied to a tree, stake, or other suitable object.

On warm days, the family can go on picnics in high-altitude parks. A QRP amateur radio station could be set up on a picnic table. In a location where there is a clear view to the east and northeast, East Coast stations can be worked easily with 5 Watts rf output. It is probable that under good conditions European stations could be worked. Such a station on a picnic table can be used to try out different kinds of antennas. The OM might want to try endfed resonant-length wires for different bands. He might want to try a 135-foot-long wire and find out how well it works on several harmonically related bands (80, 40, 20, 15, and 10 meters—see box).

An interesting antenna to try would be a 33-foot endfed vertical for use on the 20-meter band. Assuming that the pole is made of insulating material, the antenna could be taped to the pole with electricians tape. If the pole is not 33 feet tall, the top part of the 33-foot wire couid be pulled away from the top of the pole by a piece of nylon string fastened to some suitable object.

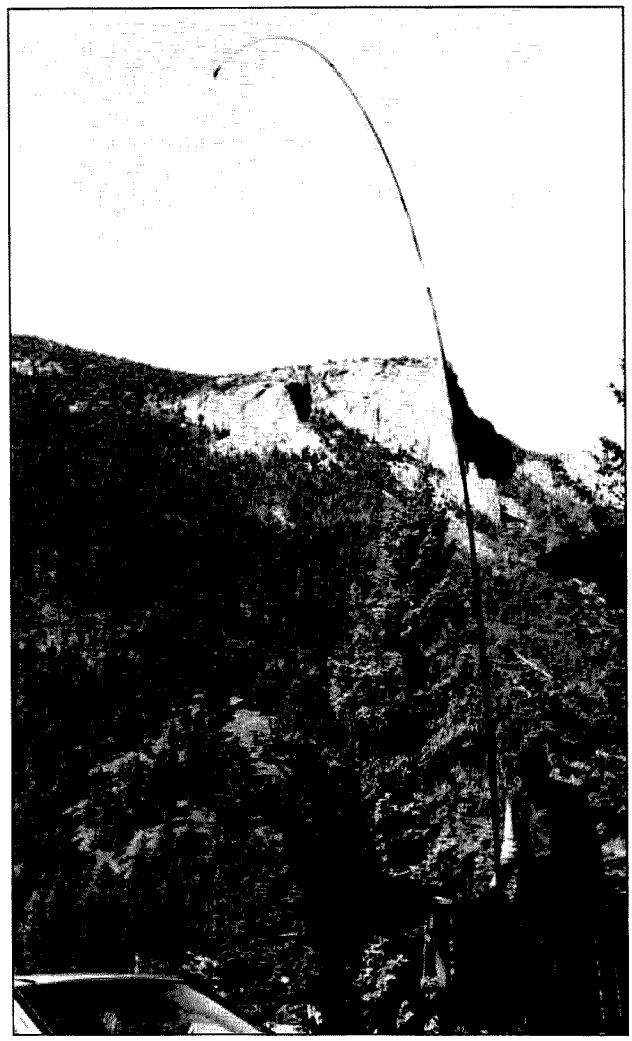


Photo B. Fiberglass fishing pole easily holds up the center of an inverted-vee antenna. W@VM stands beside it.

If one or two other poles were available, a vertical fixed-direction, wide-spaced beam could be put up. A reflector wire 35 feet long could be set up 14 feet behind the endfed antenna so that the line from the reflector to the antenna points in the desired direction. Likewise, a 32-foot wire could be positioned as a director 10-1/2 feet in front of the antenna. A two- or three-element vertical beam aimed towards Europe and located in the clear at a high elevation might well make that QRP rf output sound like 100 Watts to stations in Europe. (The vertical polarization would provide excellent low-angle radiation for "long skip.")

After the desired outdoor antenna experiments have been completed, the station can be set up in the cabin again. The OM then can operate as much as he wants to when he is "at home" in the cabin.

(In June, 1985, I set up a low-power station in a comfortable cabin north of Estes Park. The antenna was a 67-foot- long piece of insulated wire, the center of which was held up by a fiberglass fishing pole. With 6 Watts of rf power, I communicated with stations in St. Louis, Missouri; Dickinson, Texas; and Silver City, New Mexico, on my regular Tuesday evening net on 7.045 MHz. This was lots of fun!)

Since most "comfortable cabins" have ac outlets, the OM could bring his ac-powered home-station transceiver with him, and use it in the cabin.

Yes, you *can* take it with you on vacations, and have lots of fun!■

LOOKING WEST

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THE TIME HAS COME, THE WALRUS SAID

De facto mandatory frequency coordination of amateur repeaters is now a reality, more than a decade after a repeater council in California first requested it. No, I am not blowing hot air. If you were a reader of this column back in 1972 and 1973, then you may remember an organization called the Southern California Repeater Association. Shortly after SCRA was established to coordinate repeater operation in Southern California, its leaders took the initiative to write the FCC to ask for a rule change that would require pre-coordination by a recognized frequency coordinator before the Commission issued an individual a repeater license. SCRA is no more, having been split into separate 2-meter and 1-1/4-meter councils in 1979.

For those of you new to amateur radio, or who have forgotten the way things were in the late 60s to mid-70s, it was a time when you had to request a separate repeater license from the FCC and be issued a distinctive "WR" prefix call for your system. It also meant that being a repeater licensee was a sign of extreme technological competence, since you almost had to hold an EE degree to fill out the required paperwork!

Anyway, the then leaders of SCRA felt that a legislated way of controlling repeater growth patterns was needed, and they turned to the FCC. Their request was simple and, in its day, it made a lot of sense. It also followed the FCC's own pattern of that era toward heavy-handed and highly restrictive regulation of the amateur service, so it was more than a bit of a shock to SCRA when the FCC turned it down cold. In fact, I suspect that it was the rejection by the FCC of this request that made SCRA realize that the heavy-handed repeater regulations of that era could be overturned.

While the ARRL sat dormant on the issue, SCRA took on an advocate's role that eventually led to the termination of the many restrictions that had hindered the technological advancement of this communications format. In the mid-1970s, when the FCC finally agreed to meet with representatives of the amateur community to listen to complaints about repeater rules, only the Southern California Repeater Association, represented by the Palisades Amateur Radio Club of Culver City, flew representatives to Washington for this conclave. As I remember, SCRA was represented by Capt. Richard McKay K6VGP.

You may be wondering why I tell you all this. Well, it's mainly to establish the singular fact that the portion of the amateur rules recently enacted as the result of the Report and Order on P.R. Docket 85-22 is really nothing new. While it's worded differently than it might have been over a decade ago, it is still the same basic concept that SCRA under Charles Flanagan W6OLD, Fred Deeg K6AEH (now N6FD), and several other forward-looking amateurs of the early 1970s requested so long ago. I am not going to tell you that these people were prophets. Rather, they had the ability to form a group mind that understood both the complexities of repeater coordination and human nature. They realized that only through proper regulation of FM-relay technology by the FCC—regulation based upon fairness and logic rather than flat-out restriction—could this mode grow and prosper with minimal confrontation.

Alas, the FCC chose to ignore them, and for 16 years we have suffered with what can only be called "uncontrolled" growth. We have no national band plans except on 220 MHz, and there are many cities where two meters makes the 11-meter Citizens Band seem uncrowded! Had the FCC listened to SCRA in the early 1970s, by now we might have open linking of two-meter repeaters stretching coast-to-coast and border-to-border. Instead, we have big cities where repeaters serving the same geographic area sit five or six deep on a frequency where one system would suffice far more efficiently. We have more "ego box" repeaters than we know what to do with. These are repeaters that are put up and sit unused except by the repeater owner, who chases off of "his machine" anyone who shows up. Not a private or closed repeater in the sense of restrictions on membership, but rather one placed into operation to fulfill the personal ego satisfaction of someone who needs the security of being able to kerchunk his own "box" at will, for reasons I will never understand.

So, for this writer, who has chronicled the story of FM relay communications from almost the dawning of its era, it is interesting to see the Report and Order on P.R. Docket 85-22. It is almost ironic that the FCC is enacting into regulation today what a group of hams requested some 15 years ago. I have to pause and praise the current FCC administration that looks over amateur radio affairs for being a heck of a lot more cognizant of the "real world" than their predecessors were. People like Bob Foosaner, Ray Kowalski, and Johnny Johnston W3BE are the real heart and soul of the part of the FCC that guides the amateur service. Maybe, just maybe, if they had been running the show in Washington back when SCRA made its mandatory coordination request, we would not be suffering from the chaos that we are now.

A recent letter published in *QST*'s "FM-RPT" column lauded the gigantic number of repeaters we have on the air as being a justification for our existence. Bullpucky! We exist not to prove that a fat wallet and matching ego can make us "king of the hill," but rather we exist to serve humanity. It's pretty darned hard to "serve" when you have to fight the intentional QRM of a half-dozen repeaters sharing the same channel! That's nothing to be proud of. Rather, it's sheer stupidity.

I hope that the new rules enacted as the result of P.R. Docket 85-22 will finally remedy all of this, albeit maybe too little, too late. If these new rules do, you can thank Steve Mendelsohn WA2DHF for this one. Steve probably was not aware that his work on getting FCC recognition for repeater frequency coordination was started many, many years ago at a meeting in a high-school auditorium in Los Angeles. Steve is the president of the Tri-State Repeater Council of New York, New Jersey, and Connecticut, and he was the guiding force behind P.R. Docket 85-22. His wisdom and that of those who went before him have given the rest of us a chance at a new beginning. We have the rule, but where do we go from here?

What the Report and Order on 85-22 Means

With the foregoing in mind, it is probably appropriate that it would be Steve Mendelsohn who would be the first amateur-radio media representative to learn of and question the FCC on P.R. Docket 85-22. Steve and his Sony recorder got that chance at the 1986 Dayton Hamvention, when he and FCC Special Services Bureau Chief Raymond A. Kowalski sat down to talk about the issue. While many of you probably heard it on my *Westlink Amateur Radio News* in early May, it is important that as many hams as possible know of and understand the regulatory changes that this rule-making procedure brought with it. Indeed, it affects more than repeater owners and their local coordination councils. In reality, it plays a direct role in the life of every U.S. ham who operates on VHF/UHF FM through a relay device. It affects you. With that in



Enjoying the Hamvention '86 Banquet together are (l–r) Joe Schroeder W9JUV, Dave Bell W6AQ, Ray Kowalski of the FCC, and Steve Mendelsohn WA2DHF.

mind, what follows is the text of that interview:

Mendelsohn: Ray, what does the Report and Order on P.R. Docket 85-22 mean to all of us?

Kowalski: This item was adopted on April 22, 1986, and the rules go into effect on July 12, 1986. We think that there is a great deal of flexibility in the [new] rules, yet make no mistake; there's also a firm indication by the Commission that repeater coordinators perform a valuable function on behalf of everyone who wants to engage in operation in that mode, and the Commission is backing them 100%.

The important outcome of this proceeding is to establish once and for all in the amateur-radio rules, specifically Section 97.85, that when we have cases of harmful interference between repeaters or auxiliary operations, the non-coordinated repeater, if there is one involved, has the *primary responsibility to resolve that interference*!

Mendelsohn: Ray, has the Commission defined what a coordinator is?

Kowalski: Yes, we have. We have added three new definitions [to the rules]. First, there is new Section 97.3 (k) [in which] we define a coordinated station operation. That is, "the repeater or auxiliary operation of an amateur station for which the transmitting and the receiving frequencies have been implemented by the licensee *in accordance with the recommendation of a frequency coordinator*."

Now, you will note that the rule we adopted [also] spoke about harmful interference, and we have a definition for that too. *"Harmful interference is interference which seriously degrades, obstructs, or repeatedly interrupts the operation of a radio communications service."*

Finally, and perhaps most importantly, we have also defined exactly what a frequency coordinator is, and that is *"an individual or an organization [which is] recognized in a local or regional area by amateur-radio operators whose stations are eligible to engage in repeater or auxiliary operation, which recommends frequencies and, where necessary, associated operating and technical parameters for amateur repeater and auxiliary operation, in order to avoid or minimize potential interference."* The first important thing to note is that a frequency coordinator can be an individual. It does not have to be a complex organization with Articles and By-Laws, although they are OK, too. Organizations can be frequency coordinators.

Mendelsohn: What happens in an area that does not have a repeater coordinator or council, or does not feel that it has the need for one? Does that mean repeaters in that geographic region are all uncoordinated?

Kowalski: Areas with sparse populations certainly do not have to go through all of the trouble of setting up a coordinating body just so they can say they have coordinated repeaters. In fact, in the larger cities and in the urban areas where there are frequency coordinating groups, *you can still be an uncoordinated repeater—you had just better not cause interference. If you do, the Commission will look at you [as] the uncoordinated repeater.*

Mendelsohn: What effect will this Report and Order on Docket 85-22 have on Novices if they are eventually given voice and data privileges?

Kowalski: That angle was discussed in the American Radio Relay League's Petition on Novice Enhancement. [Now out for comment as P.R. Docket 86-161—Ed.] What they [the ARRL] asked was that stations in repeater operation be allowed to retransmit signals from Novice-class stations. However, Novice-class licensees could not be the control operator or the station licensee for a station in repeater operation.

In the foregoing, emphasis was added by this writer. What it adds up to is this: Neither the FCC nor a local frequency coordinator can force you to submit to frequency coordination for a repeater you now have in operation or are planning to put up. But that repeater had better not be interfering with one that has been around a longer time than yours. If it does, then you are liable for sanctions from the FCC, and this could be anything from a "nasty-gram" that says "...clean up your act" to a full-fledged Show-Cause Order aimed at license suspension or revocation in difficult cases. In the real world of big-city repeater operation, it says that the days of putting up an unsanctioned repeater are at an end. Regardless of the level of one's ego or bank account, placing a repeater into service now really means that you must obtain the approval of your peers in the local ham community before you do it, because in the real world of amateur-radio FM relay communication, failing to do so will brand you and your repeater as a "pirate" for life. The FCC says that coordination is not mandatory, but in reality it now is. Bye-bye ego-box—it's long overdue that you were buried.

Rural Input

Over the years that I have written Looking West and similar columns on FM and repeater operation, I have mainly concentrated on what's happening in the world of "big-city FM." In fact, the first five years of Looking West dealt solely with the Southern California area and the problems it faced. With the revival of this entity, I really feel that we need a broader base of informational input. A lot has changed since I began writing this column back in 1971. To this end, I am requesting that the more rural areas of our great nation stand up and be counted. You can do this by sitting down and writing to let me know what's happening in your part of the world. The stuff that's interesting will be printed. I need say no more.

Sneak Peak

Next month, in addition to FM and repeater things, you will be treated to my personal theories on the identity of the rather ill-mannered satellite-transponder jammer who calls himself "Captain Midnight." That's the guy who considers himself the "savior of the pay-TV pirates." I do not know his name or address, but I can tell you a lot about him because when he jammed HBO on the evening of April 26th, he left a calling card that any competent broadcast engineer could recognize. It will also, I hope, lead the FCC and FBI to gaining his identity and putting this fellow in jail where he belongs.■

NK6K > PACKET

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PACKET AT DAYTON

Dayton was its usual self this year. When you put 25,000+ hams in a small area along with at least one of every piece of ham equipment under current manufacture, then add the junk swap outside, you are guaranteeing an interesting time. In addition to the more normal activities, an overheated extension cord caused enough smoke to clear one building for an hour on Saturday, and an electrical problem cut the juice to most of the arena almost all day on Sunday.

Ray Kowalski, head of the Special Services Division of the FCC (which includes amateur radio), and John Johnston, who is directly concerned with amateur rule-making, were there, as well as at least one employee of the enforcement division. It seems that all hams have some sort of subliminal sixth sense that tells them Uncle Charley is near. I saw Ray Kowalski walking around and looking at various displays in the crowded arena, but even under packing densities that would make a megabit RAM-maker cringe, Ray had a clear buffer zone of about 20 feet around him—as if he were shielded by a portable "line of death." Whether it was a chill wind, raised hairs on the back of the neck, or something else, I can't say; I had no such aura and was trapped in the crowd flow, which rapidly carried me out of sight.

The FCC guys have a tough row to hoe. On one hand, they are interested in what's going on and in our thoughts on regulatory issues. On the other hand, various court decisions have enjoined them from receiving comments on pending actions outside of the official comment channels—i.e., in personal conversation. This puts them in the embarrassing position of sometimes having to say, "I can't hear this," such as at the FCC forum, when someone in the crowd insisted on commenting, even after he had been asked not to—repeatedly. The proper way to

comment on rule-making actions is later—as in this month's column.

Speaking of the FCC forum, if you were in Dayton and didn't attend, shame on you! Johnston and Kowalski went over many of the recent and pending FCC actions that affect amateur radio. This included the Novice Enhancement NPRM (notice of proposed rule-making), which would give Novices some digital privileges, and 85-105, the automatic control of packet docket.

They also used the forum to remind us once again that a phone call to the FCC with the question "Is this legal?" is usually a bad idea. Ray Kowalski said, with tongue only partially in cheek, that he has ordered the staff to always respond to that question with a "no." The fact that you are calling, said Kowalski, means that there is some doubt in your mind, and that "no" is the easiest response. As far as I know, a phone opinion is just that, an opinion, and is not legally binding.

New Products at Dayton

If you have made no attempt to chart the growth of packet radio other than to keep your eyes open at Dayton, it is still easy to see packet's increasing effect on amateur radio. This year there were eight booths in which packet was either the only topic or was the centerpiece of the items on display, and most of the dealers had packet equipment for sale. Falcon was selling a packet amplifier. ICOM had a radio that was advertised as packet-compatible. AEA was showing off its HF modem and had HF packets from Italy, Spain, and Norway pouring in. This was even more impressive to the West Coast crowd which usually sees "exotic" calls only on OSCAR 10. There were several packeteers active from the parking lot and flea-market areas. Packet forum coordinator Bob Neben K9BL did a good job this year and scheduled two separate forums on packet—one introductory and one advanced—and both were well attended.

The following is a list of the packet-related products shown for the first time at Dayton. The old standbys, or products that have been out for a while, aren't mentioned. Some of the new ones were still in prototype form. These are not product reviews, and none are necessarily recommended by your humble scribe—I haven't seen most of them in action yet.

Before the
Federal Communications Commission
Washington, DC 20554

The topic goes here	)	
	)	PR Docket No.
	)	
	)	RM-
	)	

For example:

Before the
Federal Communications Commission
Washington, DC 20554

In the matter of	)	
Amendment of Part 97 of the	)	PR Docket No. 85-105
Commission's Rules to permit	)	
automatic control of amateur	)	RM-4879
radio stations.	)	

Fig. 1. FCC petition header.

AEA

AEA has been one of the most active manufacturers, providing both new software and new hardware capabilities. This year was no exception. The PM-1 HF modem was previously announced, but just started to be shipped in April. This is a unit that can be added to any TNC, and by all reports it is a hot performer. As I said above, it was in use on their demo table, pulling in the DX.

Brand new at Dayton was the AEA PK-232, a Morse/Baudot/ASCII/AMTOR/packet box; it's similar to the PK-64, but it plugs into any computer with a serial port. It comes in two models—one with a modem (PK-232) and one without (UDC-232). A working model was on display. The packet software includes multi-connect and other advanced features, as well as some wrist-slapping messages when you set beacons and timing parameters to channel-hogging values. By the time you read this, these units should be out. No price was announced, but expect to pay more than the cost of packet-only units.

AEA was also showing off a new product that fixes one of the few complaints they've had with the PK-64. The short (too short) flat shielded ribbon cable connecting the PK-64 to the C-64 computer has been replaced with a 24-inch-long shielded flexible cable. This, along with a few software tweaks and an option to include an enhanced HF modem, is sold as the PK-64A. The higher cost of the fancy cable is reflected in the unit's higher price—$269. You can send in your PK-64 and get the new cable put on, but be prepared to pay $70 for the cable, the shielded connector, and the labor. AEA will pay the return shipping.

GLB

GLB has also been busy. A prototype of a 9600-baud rf modem (modem and radio in one box) was on display. High-speed modems will be an important part of the higher-level networks we'll be seeing in the coming months. "How fast can the radio port run?" is one of the questions you should ask when determining which TNC you want to buy. I expect to see many packeteers running faster than 1200 baud as soon as modems become available. GLB did not have a price for their modem, but said it should be ready for beta testing in six to eight weeks.

GLB also had a new TNC on display. This one will be available in the late summer of 1986. Called the PK2, it combines the features of the PK1 and the TNC2A, GLB's TNC-2 clone. In my view, the major fault of GLB's first packet offering, the PK1, was its software HDLC. This limited its radio port to 1200 baud, and also kept it from watching the keyboard and the radio at the same time, in what some have called "quarter-duplex." The new unit fixes this, and its information sheet says, "Full HDLC hardware—no compromises." The user also has the choice of the GLB-style commands or the TAPR TNC commands. GLB's handout had two pages of new hardware and software features. The PK2 will also have the capability to control the frequency on GLB's 9600-baud rf modems. Keep your eye on conventions and ads, as I expect that GLB and AEA will square off in a full-fledged feature war.

ICOM

I'll bet you didn't expect to see ICOM in the packet product list, did you? Neither did I, but on a walk past their booth, I spotted the words "packet-compatible" on the glossy for a new 2-meter radio, the IC-28H. Tom Moore and Jim Newcombe up at ICOM in Washington state tell me that "packet-compatible" means that special care was taken in the design of the radio to ensure a quick transmit/receive turnaround time. They said they believe it to be on the order of 50 ms.

Faster switching time is a good thing. It both increases frequency utilization and reduces the collision window. The shorter the time between when your TNC decides to transmit and when a signal is actually on the air, the less chance there is that someone else will decide the frequency is clear. Thanks go to the ICOM engineering staff for thinking of us, and kudos to the ICOM marketers for realizing the word "packet" sells. A free mention in the column goes to the first person to actually measure the turnaround time on the IC-28H/A and send it in.

MFJ

The MFJ TNC-2 clone, advertised for many months, made its debut a week before Dayton, and a few were in stock with dealers. At a quick glance it seems to be a faithful rendition of a TNC-2. It's in a different cabinet, and TTL levels are brought to a connector in the back for non-RS-232 serial ports.

Microlog

A large sign at the Microlog booth asked, "When is Microlog going to get into packet?" When I asked, the answer was, "We're not sure." The gentleman at the booth must have been asked that question hundreds of times, because the answer was a bit terse. it was Sunday but, on the other hand, it *was* their sign. I gathered that they missed the deadline for showing a packet product at Dayton, a state with which I am well acquainted. Keep an eye on Microlog; their unit may be out by the time you read this.

Pac-Comm

Pac-Comm had a bare board called the PC-100 for show-and-tell. This is a plug-in card for IBM-PC and PC-compatible computers. It has a Zilog 8530 HDLC chip and two AMD7910 modems. With software running on the PC, this puts a dual-port TNC on the PC's bus. This is based on a design by Terry Fox and the AMRAD gang. The PC-100 will be available in July. Pac-Comm was also selling a split-screen terminal package for the PC.

QSKY

Jim Grubbs K9EI of QSKY Publishing has written an introductory-level book on packet called *Get *** CONNECTED to Packet Radio*. It avoids technical details, which is good for an intro, and it includes a large bibliography that points the reader to the more scholarly tomes. The book also contains a large list of packet clubs and other organizations.

TAPR

The big attraction at the TAPR booth was a pin-and-yarn map of North America showing digipeater paths. Everyone who was anyone on packet stopped by to make sure his area was appropriately marked on the map. There wasn't enough time to get a photo of the map in this issue; look for it later.

TAPR had HF tuning-indicator kits for use with TNC-1 or TNC-2 clones. They also had a new introduction to packet video tape. This was done after hours on the news set in a TV studio in St. Louis. An all-ham technical staff was used for the taping. The tape includes "news" quality graphics, runs in just under half an hour, and features packet's best-known video personality, Pete Eaton WB9FLW. The tape is $10 and is not copyrighted.

TAPR also announced that the TNC-2 software source is now a part of the TNC-2 OEM package, and that it would be made available to everyone for noncommercial use in the near future. TAPR's Network Node Controller prototype was also on display.

That's the Dayton report for this year. The revolution rolls on, and it's gaining speed.

DISAGREE WITH WAYNE

Here's a chance to disagree with Wayne. It was rumored at Dayton that Wayne was talking to a group of hams in the crowd and said that maybe there wasn't enough interest among *73* readers to justify a packet column. Maybe he didn't say that, or maybe he was playing devil's advocate, but what the heck, drop him a line and tell him he's wrong anyway.

There was also a rumor that the smoke that cleared the Dayton building on Saturday wasn't an extension cord, but rather was spontaneous combustion caused by a stack of Wayne's editorials. I tend not to believe this, as they looked as if they were stacked a safe distance apart to me.

LETTERS

The first letter about *73*'s new packet column arrived while I was at Dayton. Larry Morgan K7LX wrote to ask for more information about the group in Hamilton with the PC plug-in board. I sent the following off in his SASE:

"The Hamilton Area Packet Network is selling a PC card that features a Bell 202 modem, a watchdog timer, and an 8273 hardware HDLC chip. Software running on the PC turns the board into an internal TNC. The HAPN-1 PC-Packet Adapter, assembled and tested with AX.25 host software, is $199. The address is Box 4466, Station D, Hamilton, Ontario, Canada L8V 4S7."

PETITIONING THE FCC

There are just a few simple rules to follow when you petition the FCC. Rule number one: Make sure people can read your petition. This means type it if at all possible and double-space it. Rule number two: Make some copies and send them along. Send the original and at least five copies. If you want maximum exposure, send an original and 11 copies. Rule number three: Use the standard header on the first page. See Fig. 1 for an example of this header. Mail this petition to the Secretary, Federal Communications Commission, Washington DC 20554. There are many timings involved as to when you can comment, when you can respond to comments, and when you can petition for reconsideration. If you have questions on such items, call the ARRL—dealing with the FCC is one of its major activities.

A detailed description of how to petition the FCC or comment on various FCC actions is given in *The FCC Rule Book*, published by the ARRL. See pages 2-12 through 2-16 in the 1986 edition (green cover).

If you are petitioning the FCC on a packet matter, please send a copy to the ARRL Digital Committee. It's one way we can keep abreast of what's happening, and it's a good way to indirectly notify other organizations such as TAPR, AMRAD, and AMSAT. All of us working together can get things done. The best thing to do is coordinate with the committee before you file, since a request similar to yours from someone else may already be winding its way through the mill. Knowing about it can help you make a better informed presentation of your own to the FCC. You are, of course, free to petition or comment with no coordination, or even file in opposition to the digital committee and other organizations.

WRAPUP

I promised to talk about the IC-02AT, but I've run out of space. I'll cover that and the TH-21AT next month. I also said I'd talk about the automatic control petition, but Dayton took up all the room. Just goes to show that you can't believe everything you read. See you next month.■

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

WHISTLING IN A GRAVEYARD

New York City is full of unique pleasures.

One of these is walking through graveyards. No, I'm not talking about tuning through the upper portion of the AM broadcast band, but honest-to-goodness actual graveyards.

If you have a map of New York handy, whip it out and take a look at the Middle Village-Glendale area. You'll find these amusingly bucolic-sounding towns near the center of the borough of Queens. Although placed inside one of the nation's largest cities, these neighborhoods have managed to keep a suburban flavor by being virtually surrounded by cemeteries. It's a nice, quiet area.

Anyway, my favorite graveyard is located in Brooklyn—Green-Wood Cemetery. Back in the 19th century, it was very fashionable to stroll through Green-Wood's gardens. Although the practice has sort of died out over the years (excuse me), it still can be a fun way to spend a lovely spring day. Just me, my HT, and a few silent friends.

You can find more celebrities lying down in Green-Wood than standing up in Manhattan. Some of the notables I've visited include Horace Greeley, Peter Cooper, Lola Montez, "Boss" Tweed, and William S. Hart. Quite a cast. But I recently reserved a few moments to visit with my favorite Green-Wood resident, Samuel F. B. Morse.

"Sam," I whispered, "the philistines are out to dump your code from ham radio. They say it's keeping newcomers from the hobby."

"Ham what?" replied Sam. I forgot—radio came along after Morse's demise. I filled him in on the details.

"Well, I never was much good at the darn code stuff myself," grumbled Sam. "Couldn't get much above 8 words per minute, actually. God may have wrought the telegraph, but I think a lower force was behind the code."

Sam seemed pleased that we were still using his code after so many years.

"It's a good system," he remarked. "After all, seeing as how you can't talk over wires, it's still the best way to communicate."

When I informed Sam that we can now indeed talk over wires and the air and send written messages as well, he seemed confused.

"Then why use the code?" he asked.

"Tradition," I replied. Sam then muttered something about horse transportation being more traditional than the telegraph, and asked me to move along. He told me to talk to neighbor Charlie Ebbets, of baseball park fame, if I wanted to discuss tradition. He also mentioned something else

about horses that I didn't quite catch.

Comdex vs. Dayton

I hate the people who run the Comdex personal-computer industry trade show. This year, once again, I was forced to miss Dayton to cover Comdex for another publication. Therefore, instead of looking at all the new rigs, swapping DX gossip, and shaking hands with HBO's Captain Midnight, I was forced to fly to Atlanta to talk with computer vendors, distributors, and retailers. Zzzzzz.

Incidentally, the PC market may be following the downward path of ham radio. This year's show featured both fewer exhibitors and attendees. IBM has driven a lot of fun out of the personal-computer business, and we're seeing the results. There weren't a heck of a lot of imaginative products at the show.

Nevertheless, some of the handful of interesting devices at Comdex had their roots in ham radio. I saw a number of wireless modems that drew a lot of their technology from packet-radio devices.

Also, many manufacturers were touting wireless local area networks (LANs). LANs are networking systems that tie together an office's computer work stations and peripherals. A LAN lets employees share data, printers, modems, storage devices, and so on.

Wireless LANs, quite obviously, need radio frequencies to do their thing. A number of LAN makers at the show were literally drooling over our underutilized VHF/UHF frequencies as a possible home for their systems. I heard one company's representative come right out and state that he would like to take away a portion of 220 for his firm's LANs. Incidentally, he described 220 as "an empty band that's assigned to a CB-like service but is hardly used."

Just what ham radio needs, another business interest after our frequencies.

The Puzzle

Callsigns can be fun. Bootleggers have been using them for decades. Ever speak to RG8U from Belden? Yuk, yuk.

David Flynn AA4MN of Nashville, Tennessee, has sent along a quiz that's comprised of funny calls.

His puzzler asks you to match fictional calls with the professions of hypothetical operators. In order for the puzzle to work, the numeral also has to stand for a letter: Ø for O and 1 for I. For example, an American ham in the Midwest who is a dairy farmer might end up with the call KØWS, or a saucy Swedish stewardess might get SM1LE.

Take care, some of the answers are quite subtle.

QUESTIONS

1. A Polish cook: ___1____
2. A Sardinian garbageman: ___Ø____
3. A Saudi Arabian judge: ___Ø____
4. A Japanese prison guard: ___1____
5. A Lebanese garbageman: ___Ø___
6. A Belgian shallot farmer: ___1____
7. A dentist in the Netherlands: ___1___
8. An Egyptian hog farmer: ___1____
9. A Chinese robotics engineer: ___Ø____
10. A Sudanese meteorologist: ___Ø____
11. A Haitian Santa Claus: ___Ø___
12. A Gabonese laxative distributor: ___Ø___

ANSWERS

1. SPICES
2. ISØRES
3. HZØNER
4. JAILER
5. ODØRS
6. ONIONS
7. PAINS
8. SUIPIG
9. BYØNIC
10. STØRMY
11. HHØHO
12. TRØTS

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"I just got my Isot... on 40 ... the air an... exceeded my wildest expectations. My fir... evening GS... with KB6BUC and wait—my seco... was ... HK8GUP in Columbia, South America. The ant... sits on ... 30 foot mast and that is it. My RST report... great. Congr... developing the Isotron. I am spreading the good wo... am friends. I think it's a super, compact antenna w... finally come!...KA8Q..."

"About two... ught an Isotron 80 and just recently got it ont of t... on a 35-foot pole. I am really intrigued by it an... d of fun trying to convince other statfous that it is o... igh. I worked California when it was hanging by a ... the ceiling of the shack and it works even better... N8EDF" (Photo: Isotron 160)

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*See review in October 73, 1984 **See review in March 73, 1986

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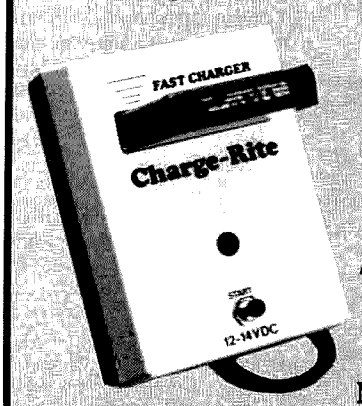
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MILITARY TECHNICAL MANUALS for old and obsolete equipment. 60-page catalog, $3.00. Military Technical Manual Service, 2266 Senasac Ave., Long Beach CA 90815. BNB045

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NEW Spectrum Analyzer/Monitor Receiver kit $60. Send SASE for details. Science Workshop, Box 393, Dept. 73, Bethpage NY 11714. BNB440

MARCO—Medical Amateur Radio Council, Ltd. Operates daily and Sunday nets. Medically oriented amateurs (physicians, dentists, veterinarians, nurses, physio-therapists, lab technicians, etc.) invited to join. Presently over 550 members. For information, write MARCO, Box 73's, Acme PA 15610. BNB441

ATTENTION Kenwood TS-430S, ICOM 745 and 751, Yaesu FT-757GX owners! Modification for general-coverage transmit the right way. Send $3 for each to W. Thomas, PO Box 96, Uniontown PA 15401. BNB445

1986 **"BLOSSOMLAND BLAST"** Sunday, October 5, 1986. Write "BLAST," PO Box 175, St. Joseph MI 49085. BNB446

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MORSE CODE. Send Wordstar documents as Morse code over computer's internal speaker. SASE for details, $7 for unprotected disk for IBM-PC and compatibles. AA4PG, 478 Cahaba Landings Road, Birmingham AL 35210. BNB450

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COMPUTER PROGRAMS for the Commodore. Antenna design, Morse instruction, logging, and others. SASE for brochure. Uncle Bill's Software, Box 2403, Falls Church VA 22042. BNB456

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TOWER CLIMBING SAFETY BELTS and accessories. Free specs. Avatar Mag., 1147 N. Emerson #7, Indianapolis IN 46219-2929. BNB458

WANTED: meter for Gonset GSB-100 transmitter. Gary Embler, 732 College Ave., Palo Alto CA 94306; (415)-424-1483. BNB459

CONTESTS

Robert W. Baker WB2GFE
15 Windsor Drive
Atco NJ 08004

CANADA DAY CONTEST
Starts: 0000 UTC July 1
Ends: 2400 UTC July 1

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single operator allband, single operator single band, and multi-operator allband.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band—once on CW and once on phone. No cross-mode contacts are allowed.

EXCHANGE:

Signal report, consecutive serial number starting with 001, and province. Do not use a separate series of numbers on each band.

SCORING:

Score 10 points for each contact with Canada, 4 points for contacts with others. VE0 counts as Canada and one multiplier. Score 20 bonus points for each contact with any CARF official station using the suffix TCA or VCA. That means an official station counts 10 points plus 20 bonus points for a total of 30 points!

Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (13 provinces/territories per band and mode maximum). Contacts with stations outside Canada count for points but not multipliers.

Provinces and territories are: VO1/VO2, VE1-NB, VE1-NS, VE1-PEI, VE2, VE3, VE4, VE5, VE6, VE7, VE8, VE0, and VY1.

FREQUENCIES:

1.810, 1.840, 3.525, 3.775, 7.025, 7.070, 7.155, 14.025, 14.150, 21.025, 21.250, 28.025, 28.500, 50.040, 50.110, 144.090, and 146.52. Suggest phone on the hour, CW on the half hour. Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

Certificates will be awarded to the highest score in each category in each province/territory, in the U.S.A., and in each DXCC country. Additionally, trophies will be awarded to the top single-op allband and multi-op allband stations.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSOs, QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier check lists are available. Entries should be mailed within one month of the contest, with your comments to: CARF Contest, c/o N. Waltho VE6VW, Box 1890, Morinville, AB, Canada T0G 1P0.

Results will be published in *TCA, The Canadian Amateur* magazine. Nonsubscribers should include an SASE for copy of the results.

IARU HF CHAMPIONSHIP
Starts: 1200 UTC July 12
Ends: 1200 UTC July 13

The IARU Administrative Council meeting in Melbourne/Aukland in November, 1985, resulted in several changes in this year's contest. Note the name change this year as well!

The three basic changes include: a 24-hour contest period for both single- and multi-operator stations, all bands between 1.8 and 30 MHz may be used with the exception of the 10-, 18-, and 24-MHz bands, IARU member/society headquarters stations count as additional multipliers and will be recognized by their unique exchange.

This contest is open to all licensed amateurs worldwide. The object is to contact as many other amateurs in as many parts of the

CALENDAR

Jul 1	CARF Canada Day Contest
Jul 12–13	IARU HF Championship
Jul 19–20	*CQ* Worldwide VHF WPX Contest
Jul 26–28	MARAC County Hunters CW Contest
Aug 2–3	ARRL UHF Contest
Aug 16–17	New Jersey QSO Party
Aug 16–17	New Mexico QSO Party
Sep 13–14	ARRL VHF QSO Party
Oct 11–12	Rio CW DX Party
Nov 1–2	ARRL Sweepstakes—CW
Nov 8	ALARA Contest
Nov 15–16	ARRL Sweepstakes—Phone
Dec 5–7	ARRL 160-Meter Contest
Dec 13–14	ARRL 10-Meter Contest
Dec 28	CARF Canada Contest
Jan 3	*73*'s 10-Meter World SSB Championship
Jan 10	*73*'s 15-Meter World SSB Championship
Jan 11	*73*'s 20-Meter World SSB Championship
Jan 17	*73*'s 40-Meter World SSB Championship
Jan 18	*73*'s 75-Meter World SSB Championship
Jan 24–25	*73*'s 160-Meter World SSB Championship

THE TSRAC BNT

NEWSLETTER OF THE MONTH

One of our favorite newsletters makes its second appearance in the NOTM corner this month, *The TSRAC BNT*. This incredible book is the chronicle of the Triple States Radio Amateur Club of Adena, Ohio, and is edited by, well, *you* try to find the editor's name! We couldn't.

The *BNT* violates just about every rule of proper publication. Pages are laid out with all sorts of strange typeface combinations, the text is crooked, photos and figures are pasted down wherever they will fit. But it's FUN to read. In the end, that's all that counts. (Incidentally, we also couldn't figure out what BNT stands for.)

To enter your newsletter in *73*'s Newsletter of the Month Contest, send it to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Newsletter of the Month.

world as possible using the bands specified above.

Operating categories include:

A) Single operator: phone, CW, and mixed-mode sections. One person performs all operating and logging functions. Use of spotting nets is prohibited. Single-operator stations are allowed only one transmitted signal at any given time.

B) Multi-operator: single transmitter, mixed-mode only. Only one transmitted signal allowed at any given time and you must remain on a band at least 10 minutes at a time. All operators must observe the limits of their license at all times. Only IARU member/society HQ stations may operate simultaneously on more than one band, with one transmitter on each band/mode. Only one HQ station's callsign per member/society is permitted on each band.

Stations may be worked once per band/mode; crossmode, crossband, and repeater QSOs do not count.

EXCHANGE:

IARU member/society HQ stations will send signal report and official IARU member/society abbreviation. All others send signal report and ITU zone.

SCORING:

Count 1 point for each QSO within your ITU zone as well as for each IARU HQ member/society station, 3 points within your continent but different ITU zone, and 5 points with different continents. Multipliers are the total number of ITU zones plus IARU member/society HQ stations worked from all bands. Final score is total number of QSO points times the total multiplier.

ENTRIES:

All entrants are encouraged to use forms available from IARU/ARRL Headquarters; send an SASE or one IRC. Logs must indicate times in UTC, bands, modes, calls, and complete exchanges. Multipliers should be clearly marked in the logs. Cross-check sheets are required if more than 500 QSOs are made. Entries must be postmarked by August 13th; any entry received after mid-October may not be in time to be included in the printed results. Usual conditions of entry and disqualifications apply. Entries should be addressed to ARRL Headquarters, 225 Main Street, Newington CT 06111.

AWARDS:

A certificate will be awarded to the high-scoring CW, phone, mixed-mode, and multi-operator entrant in each state, ITU zone, and DXCC country. In addition, achievement-level awards will be issued to those making at least 250 QSOs or having a multiplier of 50 or more. Additional awards may be made at the discretion of each country's IARU society.

CQ WORLDWIDE VHF WPX CONTEST
Starts: 0000 UTC July 19
Ends: 0000 UTC July 20

This event is sponsored by *CQ* Magazine with SCORE, the Society of Contest Operators and Radio Experimenters of Denville, New Jersey, being the administrative head of the contest committee. In this international VHF/UHF competition, multipliers are prefixes and there are eight levels of competition in each geographic area.

Classes of entry include: single operator, single band; single operator, allband; single operator, single band, low power; single operator, allband, low power; multi-operator, single band; multi-operator, allband; portable (with temporary power source); and FM-only.

Low power is defined as 30 Watts PEP output or less. All transmitters must be located within a 500-meter diameter or within the property limits of the station licensee's address, whichever is greater. The antennas must be connected by wires to the transmitters.

Use all authorized amateur bands and frequencies from 6 meters through 23 cm (50, 70, 144, 220, 432, 902, and 1296 MHz). All modes are allowed for contest credit (as authorized by local law and license class).

A prefix is considered to be the three-letter/number combination which forms the first part of an amateur radio callsign. A station in a callsign area different from that indicated by his callsign is required to sign portable. Special-event, commemorative, and other unique prefix stations are encouraged to participate.

EXCHANGE:

Callsign and "Maidenhead" locator grid square (four digits—e.g., FN20). Signal reports are optional and need not be included in the log entry.

SCORING:

Score 1 point per QSO on 50, 70, or 144 MHz; 2 points per QSO on 220 and 432 MHz; 4 points per QSO on 902 or 1296 MHz. Work stations once per band, regardless of mode. Multiply total QSO points times total number of prefixes worked on each band.

AWARDS:

Engraved trophies will be awarded to the top-scoring stations in each category and major geographic area where competition is indicated. Parchment certificates suitable for framing will be awarded to top-scoring stations in each category and minor geographic area where competition is indicated. Certificates may also be awarded to other top-scoring stations that show outstanding contest effort.

ENTRIES:

Contest entries must be postmarked no later than August 31st to be available for awards. Logs should be mailed to the *CQ* VHF WXP Contest, c/o SCORE, PO Box 1161, Denville NJ 07834, or to *CQ* Magazine, 76 N. Broadway, Hicksville NY 11801.

CW COUNTY HUNTERS CONTEST
Starts: 0000 UTC July 26
Ends: 0200 UTC July 28

MARAC invites all amateurs to participate in this year's contest. All mobile and portable operation in less active counties is welcomed and encouraged. Stations may be worked once on each band, and again if the station has changed counties. Portable or mobile stations changing counties during the contest may repeat contacts for QSO points.

EXCHANGE:

QSO number; category (P for portable, M for mobile); RS(T); state, province, or country; and U.S. county. Stations on county lines give and receive only one QSO number, but each county is valid for a multiplier for the receiving station.

FREQUENCIES:

3.575, 7.055, 14.065, 21.065, and 28.065. On 20 and 40 meters, mobile and portable stations should call CQ or QRZ below the suggested frequencies; fixed stations should call CQ or QRZ above the suggested frequencies.

SCORING:

QSOs with fixed stations are 1 point; QSOs with portable or mobile stations are 3 points. Multiply the sum of all QSO points times the number of U.S. counties worked. Independent cities may be counted as any one of their adjoining counties in accordance with USACA rules. Mobiles and portables calculate their score on the basis of total contacts within a state for the state certificate, and calculate their score on all operation if they operated from more than one state in competition for the High Portable or High Mobile plaque.

AWARDS:

Certificates will be awarded in three categories:

F) Highest fixed or fixed-portable station in each state, province, and country when total score exceeds 1,000 points.

P) Highest station in each state operating portable from a county that is not its normal point of operation, when total score exceeds 1,000 points.

M) Highest station in each state operating mobile from three or more counties (with a minimum of 10 QSOs in each of three counties).

Plaques will be awarded to the highest mobile, portable, and fixed stations in the United States that meet the above requirements for certificates. Additional awards will be issued when deemed appropriate.

ENTRIES:

Logs must show category, date/time in UTC, station worked, band, exchange, QSO points, location, and claimed score. All entries with 100 or more QSOs *must include a check sheet of counties worked or they will be disqualified from receiving awards*. Enclose a *large* SASE if results are desired. Logs must be postmarked by September 1st and sent to: Jerry Burkhead N6QA, 7525 Baltic Street, San Diego CA 92111.

ABOVE AND BEYOND

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

As this is being written, the last days of winter have gone by and spring is well along, bringing the first thunderstorms of the year and with them the attendant sporadic-E (Es) conditions that make six meters so much fun to operate during contests!

The 1986 ARRL June VHF QSO Party will long be history by the time you read this, but no doubt some Es will have been observed during the festivities and many new grids worked. It's long been a truism that if you really want to make a big score in this particular contest, you can't neglect six meters. I'll briefly relate some of the details of an operation our contest group undertook in the 1984 June VHF QSO Party under the callsign K2XR.

This was intended to be a major effort, with kW amplifiers on each of four bands—50, 144, 220, and 432 MHz. In addition, we ran 100 Watts on 1296 MHz. All of the stations used stacked yagis on good-sized towers, and the location was far enough away from prying eyes, man-made interference, and noise so as to ensure a reasonably quiet operation. Our six-meter station in particular was designed for maximum effort: It used an ICOM 551D driving a home-brew 4-1000A amplifier at the legal limit. This in turn fed two KLM 50-LD 7-element beams stacked on a 70-foot tower/mast combination.

Well, the conditions were certainly ripe for Es! This had to be one of the hottest weekends I've ever spent anywhere, and being at 1400' ASL didn't help one bit. The mercury went over the 100-degree mark several times during the weekend and stayed there, baking our crew unmercifully. We consumed gallons (and I *mean* gallons) of beverages over the weekend just to stay cool. Every fan we could employ was put into service, and most of the crew never had more than a pair of shorts on all weekend, even at night. It was *that* hot.

With the sustained high temperatures and reports of thunderstorm activity across the nation, it was only a matter of time before we would get our first big opening. But we didn't expect it to come Saturday night. Sure enough, here were S9++ signals coming in from Nebraska, Texas, Missouri, and Florida. We couldn't get them into the log fast enough.

A Janel 50-MHz MOSFET preamp helped immensely with the receiver, and the amplifier made it possible to bag extra contacts when meteor scatter was present during the wee hours of the morning. The Es opening had pretty much died down by that time, although Es can happen around the clock. Since conditions on the other bands were pretty punk, we concentrated on six meters as much as possible.

That is, until the preamplifier blew up. The intense pounding of rf from the 4-1000A proved to be too much and the preamp made an early exit Sunday morning, complete with the attendant puff of smoke. Conditions were so good by this point due to another Es opening that we really didn't need it anyway! Stations were calling us from Florida, Kansas, the Carolinas, and Oklahoma. Our group certainly was benefiting from the line of thunderstorms in the South, even if we weren't getting any of the cooling rain that came with them. Temperatures remained in the high 90s and many operators went into a cool cellar just to get back into mid-70-degree air.

Our finest hour came on the final night when we bagged additional stations in Alabama, Mississippi, Texas, and North Dakota. All of this was capped off by a contact with the Bahamas! In many cases, K2XR was the only station responded to by these operators after repeated CQs. The 4-1000A behaved very well (although it detonated its plate choke halfway through the weekend) and was the difference in some of the scatter contacts and the weaker Es grids worked. The stacked beams also helped since the angle of radiation during both Es and scatter contacts was relatively low.

Remember, though, that you don't have to run lots of power to take advantage of this phenomenon! Many times the Es is so localized and is intense enough to allow ORP contacts in the 400–600-mile range with ease—sometimes even further. Many owners of IC-502s have been lucky to work into the deep South and Caribbean during such conditions, all with no more than 3 Watts to a whip antenna. If you haven't given six meters a try lately, then a portable operation with 10–100 Watts might just be the ticket.

Keep in mind that in many instances Es on six has provided the only excitement during an otherwise routine June VHF QSO Party. It's a great way to work those rare grids, not to mention rare prefixes during the July *CQ* WW VHF WPX. Generally, the storms that provide the best openings usually occur over the mid-continent area, although storm systems in the deep South will usually provide pretty good openings.

One radio that meets our requirements nicely is the aforementioned IC-551D. This unit is still manufactured by ICOM and features an 80-Watt final with dual vfo's and multimode operation. The difference with the 551D is that it was intended to be first and foremost an SSB/CW rig, with FM thrown in as an afterthought, so the receiver performance on weak signals is very good. An outboard preamp is highly recommended, and it is easily connected via the rear-panel RCA jacks for "RCVR IN" and "RCVR OUT." You'll have to tap into the 551D for a source of 13.8 V dc.

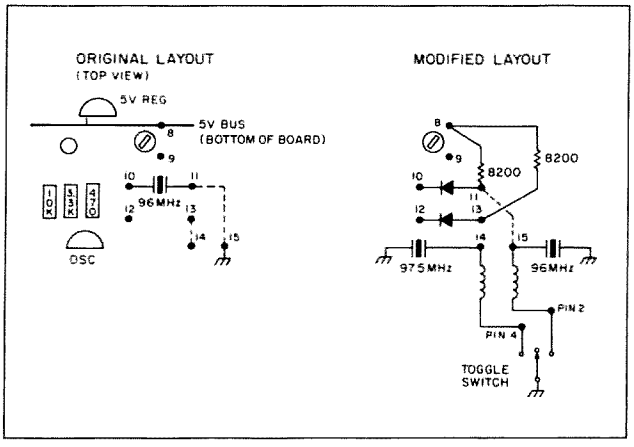


Fig. 1. VE3CRU's modifications to allow dual-range crystal switching on the MMT 220/28.

1. *Remove 96-MHz crystal from pins 10 and 11.*
2. *Remove 10k resistor.*
3. *Install 1N914 diode from pin 10 to pin 11 with cathode at pin 10.*
4. *Install 1N914 diode from pin 12 to pin 13 with cathode at pin 12.*
5. *Remove ground wire from pin 15.*
6. *Install 10-uH choke from pin 15 to DIN socket pin 2.*
7. *Install 10-uH choke from pin 14 to DIN socket pin 4.*
8. *Install 96-MHz crystal from pin 15 to PC foil ground.*
9. *Install 97.5-MHz crystal from pin 14 to PC foil ground.*
10. *Install 8.2k resistor from pin 8 to pin 11.*
11. *Install 8.2k resistor from pin 8 to pin 13.*
12. *Install SPDT center off toggle switch on connector panel above DIN socket.*
13. *Connect center pin of switch to ground.*
14. *Connect pin 2 of DIN plug to one side of switch.*
15. *Connect pin 4 of DIN plug to other side of switch.*

Theory of operation—The crystals are coupled to the oscillator-transistor base via a switching diode. One of the crystals is disabled by grounding the appropriate pin on the DIN socket or by using the toggle switch. The diode on the inactive crystal will be back-biased about 1 volt, thereby disabling it. Using a toggle switch to change the crystals directly is not recommended since the stray capacity across the switch is sufficient to permit oscillation. The toggle switch can be used to select frequency. In the center off position, frequency selection is done remotely by grounding the proper pin on the DIN socket.

(Incidentally, ICOM also made a 10-Watt version of this radio, called the 551, which is still available on the surplus and hamfest market.)

However you choose to do it, six-meter operation can be extremely satisfying. Concerned about TVI? Go mountaintop portable, or even mobile, for the contest. ICOM also makes the only six-meter portable on the market, the IC-505, with a choice of 3 Watts output using internal batteries or 10 Watts with an external supply. Used with a small car or RV battery, it makes an excellent weekend station, especially with an outboard 100-Watt amplifier such as the Mirage A1015. If the Es is good, go barefoot, and you'll be amazed at what you can hear when the propagation works for you!

More 220

Now I can report to you 220 enthusiasts that there is another way to get more mileage out of your station. For those using the Microwave Modules MMT 220-28 transverter, simply replacing the 96-MHz LO crystal with a 97.5-MHz crystal will yield a conversion of 220–225 MHz down to 25–30 MHz. If you are currently using one of the newer low-band general-coverage radios, you need to enable the set for general-coverage transmit. *Caution:* Don't attempt to run power out of the authorized amateur bands. You will need about 10–50 mW of drive in the range of 25–30 MHz to make the conversion work, and this shouldn't cause any problems in a closed-loop system to the transverter.

I have performed this modification with my MMT 220-28 and am now able to work SSB, CW, and FM (plus repeaters) with one source, running 15+ Watts output. The only catch is that you have to program the repeater inputs and outputs separately, but I use only two or three machines on 220 anyway and this isn't much of a bother. Plus, it yields the popular 223.50 simplex frequency and there's plenty to work here. If you choose not to convert your unit or can't (such as IC-730/740 users, TS-820/830, etc.), then there is at least a way to get on simplex FM by using the crystal switching scheme shown in Fig. 2. This circuit is courtesy of Hans Peters VE3CRU, who is making it standard equipment on all MMT 220-28 units made after March 1, 1986. If you are limited to the 28–30-MHz i-f range, you'll at least have coverage of the 223–225 segment and can work simplex for FM or packet. This frees your HT for other uses and buys superior weak-signal performance on the low end of the band as well.

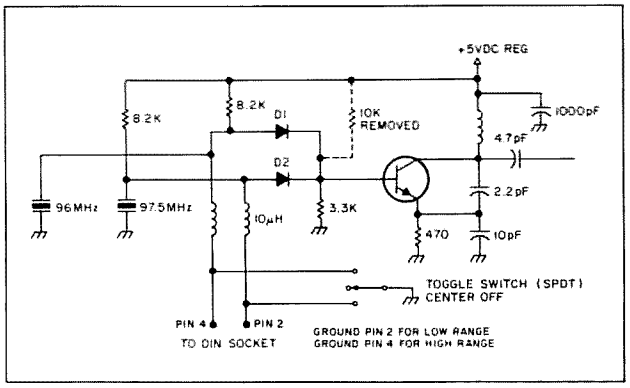


Fig. 2. Schematic of the dual-range modification.

Mailbox

Fred Church WA5YOV writes in to comment on the February, 1986, column statement regarding attenuator pads. He wants to know if using a pad between his Heathkit HW-104 and an MMT 144-28 to drop the drive level from 1 Watt down to about 50 milliwatts would result in less receiver conversion gain going back the other way. Well, first of all, Fred, the typical MMT 144-28 has about 20 dB of conversion gain, which is usually more than adequate for your low-band receiver. If you employ the transceiver connection at 28 MHz and put a pad in the line, your drive level on transmit and conversion level on receive will both be reduced.

Using a 6-dB pad will result in a drive level of 250 mW, which is fine for the MMT 144-28. It will reduce your conversion gain to about 14 dB, which is still plenty for the HW-104. Note what your S-meter readings are when listening to 144 MHz with no pad present and in no-signal condition. I'll bet that your S-meter is sitting at around S1 or even S2. Losing 6 dB of conversion gain will bring it back to about S0, which is where you want it anyway! Remember, this has no effect on the received signal at 144 MHz, although many users seem to be confused on this point. Such an attenuator could be picked up at a flea market or made up from three 150-Ohm, 1/4-Watt, carbon-composition resistors.

Fred's concern is that dropping the drive level inside the HW-104 might affect the linearity of the signal, especially on SSB. This method of cutting the drive shouldn't affect the linearity at all, since the 1 Watt of rf output is looking into a fairly nonreactive 50-Ohm load. Enough of the energy is dissipated by the resistors to bring the drive down to a safe level. And your receiver conversion shouldn't be impaired one bit.

Contest Update

The new rules for the *CQ* Worldwide VHF WPX have been released, which is no surprise to me since I was involved in their formulation. For those readers who took some time off to throw together a portable station and get on during the festivities (or who just operated from their home station from ac mains), here are the details: The date—July 18–20, the format—48-hour contest period, and the allowable bands—50, 70 (Europe), 144, 220, 432, 902, and 1296 MHz. The eight categories of competition stay the same (single/single, single/multi, single/single QRP, single/multi QRP, multi/single, multi/multi, portable, and FM-only). The big difference is that grid squares are now included as the exchange and will replace the serial number from last year.

If you don't know or care about your grid square, a location report or signal report will suffice. This information has no effect on the final score, which is still solely determined by prefixes worked. Many stations wrote in to request the grid-square multiplier, so they could continue collecting grids for VUCC on various bands. This is really a fun contest and ties in perfectly with May's column on portable operation, since there are specific classes for QRP and portable competition. I'll certainly be on and hope to work you as well!

Good News

The popular K2RIW 19-element 432-MHz yagis are once again being manufactured after a long layoff and are available from Tom Rutland K3IPW at 1703 Warren Street, New Cumberland PA 17070. This antenna uses exceptional construction, including a soldered driven element. It's priced at $69.95 in kit form plus UPS charges.

Not Again?

I've just received the latest newsletter from the Mt. Airy VHF Radio Club, otherwise known as the PackRats (not to be confused with the AEA product with a similar name!). This club has had a stranglehold on the January VHF Sweepstakes Unlimited class for the past 25 years or better. Why? Because this is an active, involved club whose members travel to all sorts of crazy places to put signals on the air, from 50 MHz right up to 10 GHz! What's more, they really enjoy it, too. I've been to a few meetings and can tell you that this club takes its VHF and UHF activity seriously.

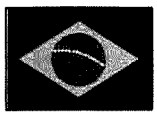
For example, a total of 59 logs were sent in to the club to be posted with the Club Aggregate Score in the Unlimited class. How'd they do? Only about 1.8 million points, that's how! The ARRL ought to change the name of this class to the PackRat Contest Demo class, for theirs is an excellent example of how to organize a large group effort successfully. Others have tried, but the Mt. Airy folks keep plugging along, year after year. Many hams on the East Coast are familiar with their annual VHF conference and flea market which occur the first weekend in October. In addition, the club also runs VHF nets on 50 through 1296 each Monday night, starting at 7:30 p.m. EST. Check-ins come from as far away as North Carolina and Maine! It's a great way to find activity to test out that new piece of gear or to evaluate station improvements.

I'll have a piece down the road on this active radio club. For those who might like more information, the newsletter is very well done and can be had by writing to the editor, Harry Stein W3CL at 2087 Parkdale Avenue, Glenside PA 19117.■

73 INTERNATIONAL

Just because I started this column as a result of visiting DX hams is no reason you shouldn't put in your 2¢ worth and let me know what DX news you find most interesting. My inclination is to have DX ops tell us what they think is interesting—how we can get permission to operate if we're fortunate enough to visit—any coming DXpeditions—what's doing with repeaters—things like that. What do YOU find most interesting? Since we have a world hobby, I think you'll be as interested as I in what is going on. If nothing else, it gives us something to talk about on the air which, from what I'm hearing these days, can't hurt.

—Wayne.



BRAZIL

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PO Box 12178 Copacabana
20000 Rio de Janeiro, RJ
Brazil

Carlos Vianne Carneiro PY1CC
Rua Afonso Pena 49, Apt. 701
20270 Rio de Janeiro, RJ
Brazil

FOR OX MEMBERS

After five years, I visited the city of Fortaleza again. It is located in the State of Ceara northeast of Brazil, and like all Brazilian cities located along the coast, Fortaleza has paradisiacal beaches. Due to its location in South America, it is one of the best places in the world for DXing. So, the PT7 stations are quite active and are always looking for a rare spot on the bands. Most of them are members of a DX club called Fortaleza DX Group (FOR DX), which maintains a special VHF spotting frequency. Every member knows about a DX-pedition or a very wanted station on the air. On this trip, I found DXers like Luc PT7WA, Eli PT7BZ, Pergentino PT7AA, and Freire PT7WZ, old friends I didn't know personally before.

Luc PT7WA (formerly PY7VNY) was one of the first Brazilians to get the 5-band DXCC. He is still very active on the low bands, and is now looking for the 5-band WAZ. Eli PT7BZ and Freire PT7WZ work phone only. Pergentino PT7AA is most active on CW.

Eli's DXCC score is now 292 but he already has the 5-band DXCC and 5-band WAS. Now he is working for the 5-band WAZ and needs only a few zones on 80 meters to finish it. His last interest is the 160-meter band, where he already has 82 confirmed countries. Eli showed us his shack where he displays a few rigs—almost one for each band. PT7BZ confirms all QSOs with his QSL, but if you need a direct QSL you can ask him for it at PO Box 2875, Fortaleza, 60000 CE, Brazil.

CWJF AWARD

Sponsored by the CW Group of Juiz de Fora, the CWJF is available to all licensed amateurs for confirmed contacts with five stations located in the city of Juiz de Fora after January 1, 1985, on any amateur band. Only two-way CW contacts count. The same station may be worked on different bands but with a minimum interval of 24 hours. Send GCR log of stations worked (call, date, time, band, mode, and report) and 10 IRCs to: CWJF Award, PO Box 410, 36100 Juiz de Fora, MG, Brazil.

There are no special endorsements for the CWJF Award.

SWL: Same rules.

CWJF members: PP1AEA (PY4CZ), PU4WAS (PU8), PU4WIG, PU4WLF, PU4XFD, PU4XIA, PY4AG, PY4AKR, PY4ALC, PY4ALV, PY4AMP, PY4EG, PY4EM, PY4CY, PY4QA, PY4QE, PY4QV, PY4RU, PY4YN, PY4ZAX (KA2UFT), and PY4ZF.

de **PY1APS/PY7APS**

NEW BANDS FOR BRAZIL

New radio-amateur services, approved by Decree number 91.836, will take effect on October 12, 1986, allowing Brazilian radio amateurs to operate two of the three new bands, the 18.068–18.168-MHz and the 24.890–24.990-MHz segments, both on a shared basis until January 7, 1989, after which they will be exclusively for radio-amateur operations.

Only Class-A Brazilian operators are allowed to use these new bands, and these are allowed emission types for these bands: N0N, A1A, A1B, A1C, A1D, F1A, F1B, F1C, F1D, A2A, A2B, A2C, A2D, F2A, F2B, F2C, F2D, J2A, J2B, J2C, J2D, A3A, A3B, A3C, A3D, A3E, H3E, J3B, J3C, J3D, J3E, J3F, R3A, R3B, R3C, R3D, R3E, and R3F.

The third band is not yet allowed for radio-amateur use because government safety services and aeronautics services are still using it and there was not enough time to change frequencies and equipment. As soon as these services move to other frequencies, authorities will allow the remaining new band to be used by radio amateurs. We'll pass along the word.

de PY1CC



COSTA RICA

Bengt Hallden TI4BGA
Box 999
3000 Heredia
Costa Rica

73 International welcomes Costa Rica and Senor Hallden, who has been appointed by the directors of the Radio Club de Costa Rica to keep us all informed of amateur-radio events and developments in that country.

Amateur radio in Costa Rica is definitely growing very fast, and licensing is increasing rapidly. HF as well as VHF traffic on the different amateur bands involve more and more Costa Ricans.

The 2-meter band is the most popular, and there are more or less 12 repeaters covering the whole territory, including one channel for autopatch. If you are interested in the different repeaters' frequencies, write the RCCR at TI0RC, Apartado Postal 2412 San Jose 1000, San Jose, Costa Rica.

Regarding licensing proce-



Photo A. PT7BZ's QTH.



Photo B. L to R: PY1APS, PT7AA, PT7BZ, and PT7WA.

dures here in Costa Rica, especially for visiting tourists, it is not very complicated. I would say rather that it's a quick operation as long as all the required documents are in good order. Costa Rica has a reciprocal agreement with the U.S.A. (and Austria, Argentina, Brazil, Venezuela, Chile, Peru, Canada, Mexico, Panama, Switzerland, Belgium, Bolivia, Nicaragua, Ecuador, Belize, Dominican Republic, and the Federal Republic of Germany), thus enabling the tourist to operate from here more or less the same day he arrives.

A must, of course, is the presentation of a valid amateur license when applying for a reciprocal license.

The only exception for the use of your reciprocal license is that it isn't permitted from the Isle of Cocos (TI9). However, if someone should be interested in operating from Cocos Island, arrangements can be made with the RCCR and, if accompanied by some local ham, operation might be possible.

The RCCR has a QSL Bureau with monthly dispatching of QSL cards. Third-party traffic is possible, and special callsigns for prefix hunters are mostly appearing during international contests when TI1 and TE2-TE8 can be heard—also TE1.

Regarding certificates and awards, the RCCR is sponsoring the TTI Award (see below). Any SWL or amateur can obtain this after hearing/contacting seven of the eight call areas of Costa Rica. (The club station, TI0RC, can replace any absent call area.) Send GCR list to me (Sr. Hallden is RCCR treasurer and Diploma Manager) with 10 IRCs or U.S. $5.

The idea of DXpeditions with 20 hams visiting Costa Rica sounds very interesting and, of course, operating possibilities when arriving and during a stay here are guaranteed; in other words, such a group of hams would be very welcome! Just let us know!

The RCCR phone number is 216903, and our office in San Jose is on the central avenue between 1st and 3rd Streets near Hotel La Gran Via. You may call me at 395372, Luis Retana at 220545 or 530393, or Jimmy Vincent at 210012 during office hours.

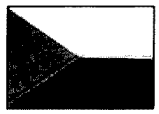
DIPLOMA FRACAP

The Federation of Radio Amateurs of Central America and Panama (FRACAP) announces a beautiful diploma for radio amateurs and SWLs to raise interest in the member countries of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama.

Requirements are: two-way confirmed contacts after August 16, 1985, any band, any mode, with each of the six countries, with amateurs who are members of a FRACAP radio club.

The application has to be accompanied by the QSL cards or a GCR list verified by the radio club of which the applicant is a member. Applications should be accompanied by 10 IRCs or U.S. $5 and should go to the RCCR Awards Manager at the address above.

73 and Health!



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Gogol'ova 1882
955 01 Topol'cany
Czechoslovakia

Annually in Czechoslovakia the best individual stations, as well as those of radio clubs in the competitions on shortwave, are being evaluated. For the year 1983, the following results were achieved:

Radio clubs
OK1KRG—75 points (the maximum)
OK1KSO—69 points
OK3KCM—55 points

Individuals
OK2FD—75 points
OK2BHV—63 points
OK1AVD—61 points

RTTY

The operators of radio club OK3KJF made contact with station A92DU from Bahrain island. It was their 109th DXCC list country. They work with the machine T-100 and ground-plane antennas and HB9CV.

Station OK1DNH from Rotava works on RTTY by using a ZX-81. The ZX-81 works without any problems on the lower bands, but on the higher bands it has some problems with RFI.

A very nice placement was achieved by Czechoslovakian stations in the category of multi-operators in the Alexander Volta RTTY Contest 1984. The first three places were occupied by OK3KGI, OK3RMW, and OK3KEF.

UHF/VHF

OK1VRF encountered a signal of station OE5XUM on the frequency of 144.595 MHz on May 11, 1985, at 5 p.m. UTC. The station was located in the mountains near Salzburg as a radio-teleprinter converter, by modulation F1B, shift being 850 Hz, input of 80 Watts.

RTTY transmission has begun for the station of the Central Czechoslovak Radioclub, OK1CRA. The transmission is in the shortwave band as well as through converters in the UHF band.

After two years an experimental marathon SNERA has ended. In this marathon, the Soviet radio-amateur stations were competing to make as many contacts as possible on UHF bands by means of a polar glow.

The category of individuals was won by: UA3BMJ—155 contacts via polar glow for 5,442 points, UR2RQ—139 contacts for 3,795 points, and UA9XQ—149 contacts for 3,159 points.

The category of collective stations was won by radio club UZ9CXM with 23 polar-glow contacts, and the SWL category was won by UA3-142-198 with 9 polar-glow contacts.

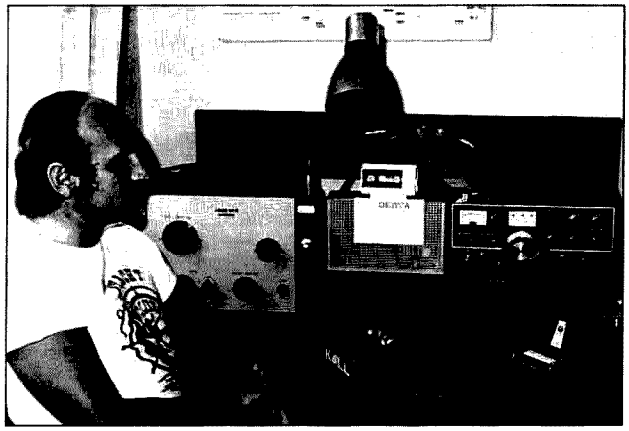


Photo C. Ed OK3EY (ex-OK3TCA), one of Czechoslovakia's best DX men.

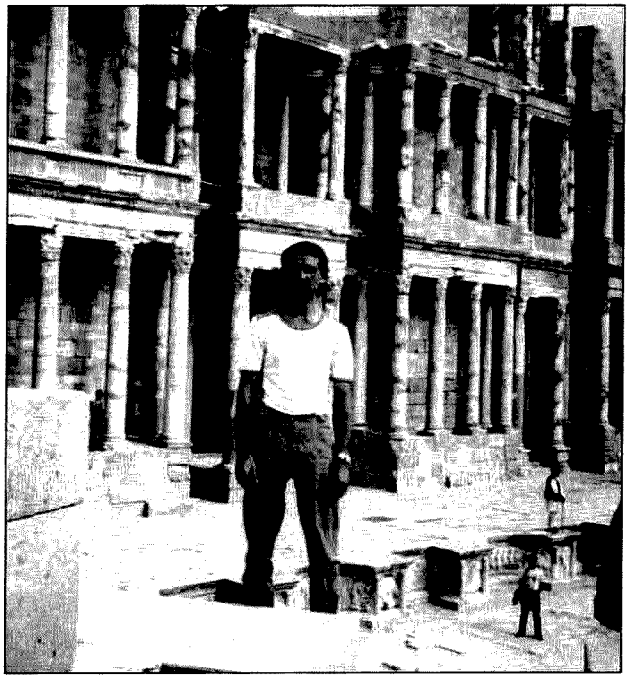


Photo D. 73 correspondent Rudy OK3CMZ in Sabratha, 5A-land.

DX

LY4L has a special antenna that was transmitting from Ulianovsk in 1985 on the 112th anniversary of the birthday of V. I. Lenin.

QRP

Igor OK3CUG belongs to the friends of the operation with small inputs, which made 1,300 QRP contacts on the 3.5-MHz band, 840 of which had output of 600 milliwatts. Igor was working with 40 lands according to the DXCC list, the rarest being W1, CT2, UF, and UA9.

Jirka OK1FAO has been working mainly on 3.5 MHz. He used equipment of his own construction with aninput of 2 Watts and made 600 contacts.

The callsign OK1DCP is known from many QRP contests. Franta belongs to the most active operators with QRP in Czechoslovakia. Since 1976 he has made more than 5,300 contacts on the 160- and 20-meter bands. These contacts were made with homemade equipment with an output of 3 to 5 Watts. He has been specializing on the 7-MHz band, operating CW.

Jan OK3ZAP has constructed a homemade CW/SSB transceiver for 3.5 to 21 MHz with an output from 120 milliwatts to 5 Watts. On the 21-MHz band he has worked as many as 55 lands on the DXCC list.

Jarda OK3AUI is a very active QRP operator. With his equipment of 5 Watts input, since 1980 he has made approximately 5,000 contacts, 1,000 of which were on SSB.

Olda OK1DAV works with QRP of his own production with an input of 0.5 to 8 Watts. With wire antennas, operating CW, he worked 50 DXCC lands. In the *CQ* WW DX Contest, he made contacts for the diploma WAC during 12 hours on the 21-MHz band.

Jirka OK1MYN works with QRP on the 14-MHz band with his CW/SSB transceiver with an output of 4 Watts. He worked 74 DXCC lands.

WINNERS OF THE 1984 OK-DX CONTEST (XXVIII)

Top five stations worldwide:

Call	QSOs	Points	Multipliers	Totals
Single-op—multiband				
UA1DZ	1,351	2,118	83	175,794
LZ2WF	1,302	1,738	92	159,896
HA7UO/P	1,198	1,445	98	141,610
RB5MF	1,166	1,856	67	124,352
UH8EAA	1,072	1,556	76	118,256
Multi-op—multiband				
OK5R	1,552	1,547	115	177,905
OK6RA	1,237	1,228	110	135,080
UZ4FWO	1,117	1,813	62	112,406
UB4QWW	900	1,464	63	92,043
OK1KSO	1,012	1,006	90	90,540
Single-op—1.8 MHz				
LZ2BE	281	426	14	5,964
YU4YA	162	334	10	3,340
UP2BLF	172	330	7	2,310
G3ZRH	128	241	8	1,928
UB5REN	103	204	9	1,836
Single-op—3.5 MHz				
UP2BM	576	929	13	12,077
YO3CD	556	837	13	10,881
HA6NL	539	805	13	10,465
Y27IO	521	748	13	9,724
Y56YF	495	774	12	9,288
Single-op—7 MHz				
HA1XR	690	857	32	27,424
UA2FFC	654	839	30	25,170
LZ2SC	853	750	27	20,250
LZ1SS	541	686	29	19,894
LZ1NG	514	665	29	19,285
Single-op—14 MHz				
OK1TN	565	565	34	19,210
UA4PNW	381	697	24	16,728
I2VXJ	431	534	30	16,020
SM2DQS	417	683	21	14,343
OH6QU	346	594	23	13,662
Single-op—21 MHz				
UA0SAU	394	531	20	8,620
UA3TU	95	100	19	1,900
UA4HLD	106	155	12	1,860
LU4FDM	134	201	6	1,206
LZ1TD	57	62	19	1,178
Single-op—28 MHz				
JO1CRA	30	28	9	252
OK2BEW	10	10	6	60
OK3CPY	1	1	1	1

Table 1.

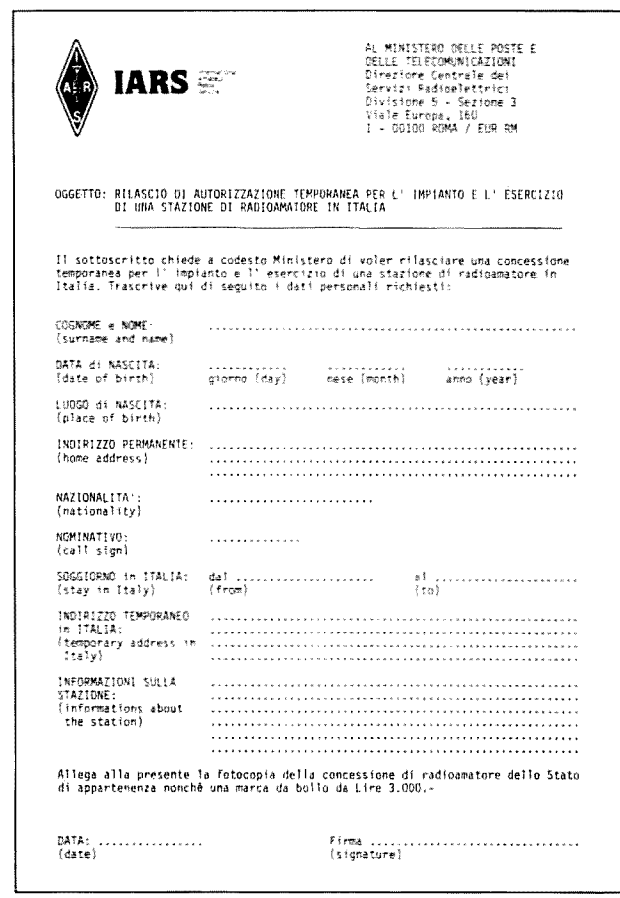


ITALY

Manuel F. Calero I4CMF
Manager, IARS
Reciprocal Licensing Unit
Via Giorgione, 16 I
40133 Bologna
Italy

The following has been extracted from material dated January, 1986, provided by Signore Calero. He may be addressed as above or telephoned (from inside Italy: 051 389502; international number: 0039 51 389502). Phone calls are answered in English, Spanish, and French between 8 and 10 p.m. UTC, except weekends.

Amateurs from the following countries are eligible for nonextendable three-month permits for brief vacation or study visits: Austria, Belgium, Canada, Cyprus, Denmark, France, Federal Republic of Germany, Great Britain, Greece, Iceland, Ireland, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, Norway,



IARS

AL MINISTERO DELLE POSTE E
DELLE TELECOMUNICAZIONI
Direzione Centrale dei
Servizi Radioelettrici
Divisione 5 - Sezione 3
Viale Europa, 160
I - 00100 ROMA / EUR RM

OGGETTO: RILASCIO DI AUTORIZZAZIONE TEMPORANEA PER L' IMPIANTO E L' ESERCIZIO DI UNA STAZIONE DI RADIOAMATORE IN ITALIA

Il sottoscritto chiede a codesto Ministero di voler rilasciare una concessione temporanea per l' impianto e l' esercizio di una stazione di radioamatore in Italia. Trascrive qui di seguito i dati personali richiesti:

COGNOME e NOME: .....
(surname and name)

DATA di NASCITA: ....
(date of birth) giorno (day) mese (month) anno (year)

LUOGO di NASCITA: .....
(place of birth)

INDIRIZZO PERMANENTE: .....
(home address) .....
.....

NAZIONALITA': .....
(nationality)

NOMINATIVO: .....
(call sign)

SOGGIORNO in ITALIA: dal ..... al .....
(stay in Italy) (from) (to)

INDIRIZZO TEMPORANEO .....
in ITALIA: .....
(temporary address in .....
Italy) .....

INFORMAZIONI SULLA .....
STAZIONE: .....
(informations about .....
the station) .....
.....
.....

Allega alla presente la fotocopia della concessione di radioamatore dello Stato di appartenenza nonché una marca da bollo da Lire 3.000.-

DATA: ..... Firma .....
(date) (signature)

Fig. 1. Application for an Italian temporary license.

Portugal, Spain, Sweden, Switzerland, Turkey, and U.S.A. Application may be made for another three-month permit, however, and up to four consecutive permits may be granted.

Amateurs intending to remain in Italy for more than a year must first register their residence location and then follow procedures established for Italian nationals.

Applications from abroad may be on plain paper, following the format shown in the box. In Italy, revenue-stamped paper (*carta legale* or *carta da bollo*) must be used. Provide the information in Italian.

Enclose 5,800 lira or IRCs of that value (as of January, an IRC had the nominal value of 650 lira) and a photocopy of your station license, which must be valid for the period for which the temporary permit is requested. (For overseas air mail service, enclose an additional 4,700 lira.) Special delivery or registered mail for the application is recommended.

If the application is sent direct to the Reciprocal Licensing Unit (above address), U.S. $10 *in cash* may be sent instead to cover all expenses. An additional U.S. $5 will pay for the permit, and your receipt will make it unnecessary for you to visit the Italian Ministry of P e T to pay that fee. *Remember: checks and postal money orders are NOT acceptable.* It is strongly recommended that permits be obtained before coming to Italy, and that applications be made six to eight weeks in adavnce of your departure.

The callsign you will use in Italy will be your own followed by a slash and the prefix of the Italian call area in which you are operating at that moment.

The Italian licensing administration (to which calls and correspondence should be in Italian) is the Ministero delle Poste e delle Telecomunicazioni, Direzione Centrale dei Servizi Radioelettrici, Divisione 5–Sezione 3, Viale Europa, 160, 1–00100 Roma/Eur Rm, Italy.

Notes on filling out the application: WRITE IN CAPS! (1) Write family name followed by first name and middle name. (2) Write date in numbers. (3) Town, village, and state. (4) Complete home address—as on your amateur license if it is the same. (5) From (in numbers) day/month/year To day/month/year, not to exceed 90 days. (6) Write complete address of the home, hotel, campground, etc., where station will be operated. Note: Mobile service is permitted only on VHF/UHF bands and up, but *do not* specify mobile operations on this form. New regulations are pending. (7) Manufacturer and model of equipment with the rf power (input). For HF bands, input must *not* exceed 300 Watts; for VHF/UHF and up, the input limit is 10 Watts. Specify type(s) of antennas to be used.

CORRECTIONS

An error found its way into VE1VQ's article, "Build a Dynamic Duo," in the February, 1986, issue. The schematic for the cigarette-lighter adapter (formerly Fig. 4) originally showed a short from the base of transistor Q3 to the collector of same. Capacitor C1 (.001 uF) should appear in place of the short. The corrected schematic is shown here in Fig. 1.

In John Coppens' article, "132 Extra Memories For Your FT-107M," published in the March, 1986, issue, transistors T1–T4 should be replaced with BC547s or other suitable NPN transistors.

In the May, 1986, International section, the wrong flag was used with the Republic of China column. *73* regrets the error.

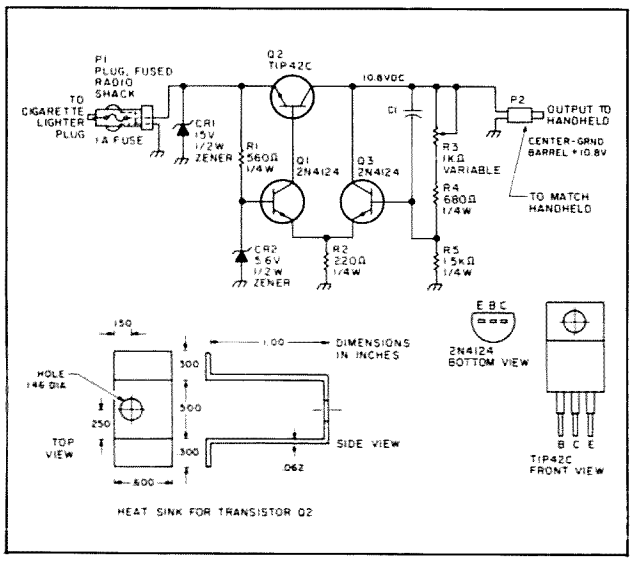


Fig. 1. The corrected cigarette-lighter adapter schematic.

SATELLITES

USING THE AO-10 PREDICTIONS

Apogee predictions for the month of July are provided for three sections of the United States: Washington, D.C.; Denver, Colorado; and Los Angeles, California. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

July 1986

		WASH		DENVER		LA	
DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1	1552			213	13	192	25
2	1511	228	4	204	16	192	25
3	1430	221	9	195	19	181	26
4	1349	213	14	185	20	171	26
5	1308	204	17	175	21	160	24
6	1227	195	20	165	19	151	21
7	1146	185	21	156	17	142	16
8	1105	175	22	147	13	135	11
9	1024	165	20	140	9	128	5
10	0943	155	18	131	4		
11	0902	147	14				
12	0821	138	10				
13	0740	131	5				
15	1758					238	0
16	1717					232	6
17	1636			233	7	225	12
18	1555			226	6	217	17
19	1514			219	11	208	22
20	1434	233	1	210	15	199	25
21	1353	226	7	202	19	188	27
22	1312	219	12	192	21	177	28
23	1231	211	16	182	22	167	27
24	1150	202	20	172	22	156	25
25	1109	192	22	162	20	147	21
26	1028	182	23	152	17	147	21
27	0947	171	23	143	13	131	10
28	0906	161	21	135	8	124	4
29	0825	152	18	128	3		
30	0744	143	14				
31	0703	135	9				

Ham Awards

Ten American Districts Award

by William V. R. Smith N6MQS

With this issue of *73*, I am pleased to present the first of a series of articles about the many awards available to ham radio operators. Along with information about the rules and requirements of each award, I will present award forms, or worksheets, to help you keep track of your contacts.

Ham awards are presented by clubs and associations to recognize operating achievement. There are many types of awards for all levels of achievement. No matter what your license class, or the amount of time you devote to ham radio, there *is* an award for you.

A Novice can spend a month contacting stations in each of the ten American call districts. A General-class operator tries to work all states during a 48-hour contest.

If you've earned an award, then you know the pride felt when it finally arrives in the mail. If you are working for your first award, just keep working—it's worth the effort!

Many awards have special endorsements. An endorsement is awarded in recognition of a special operating achievement. CW-only, single-band, OSCAR, QRP, RTTY, and SSTV are examples of special achievement. The same award may be earned many times with different endorsements.

When you apply for an award, you must submit proof of contact with the required stations. Proof is most often considered to be valid QSL cards from each of the stations contacted. You may be required to send the QSL cards along with the application. (If you want the cards returned, you must send sufficient postage with your application.)

Some clubs will accept a verified list instead of QSL cards. Each club has its own rules about what constitutes a verified list. Most often a list showing callsign, date, time, mode, and frequency is sufficient, provided it has been checked by two other ham operators or a club official.

A fee is often charged for each award. This covers the cost of printing and the postage to send you the award.

I'll start this series of articles with a relatively easy award: The Ten American Districts Award (TAD), sponsored by the Lockheed E.R.C. Amateur Club (W6LS).

The TAD Award requires contacts with operators in each of the ten U.S. call districts. This award is available to all licensed amateur radio operators and clubs. DX stations are also welcome.

The TAD Award requirements are very broad and are listed below, along with the correct mailing address. With this award, you have a choice of sending your QSL cards or using a verified list. Make a note on the application if you want a special endorsement.

I have created a TAD award for you to use as your verified list. You may use this form even if you send in your QSL cards.

The award fee is very reasonable—one dollar with a verified list or two dollars with QSL cards (to cover return postage). DX stations must add one dollar for the increased postage. Cash, check, IRCs, or U.S. stamps are accepted.

Mail your application, along with payment, by regular mail. The TAD Awards are processed by the 19th day of each month.

73 and I hope to work you on the air. I'll be back next month to feature another award. Good luck with the TAD Award.

Ten American Districts Award Requirements:

- Contacts with all ten American districts must have been made from the same call area.
- Hawaii counts as the 6th call district.
- Alaska counts as the 7th call district.
- Contacts can be made to and/or from fixed, mobile, portable, or fixed-portable stations.
- Crossband and crossmode contacts are allowed.
- If your callsign changes, contacts made using your previous callsign are still valid as long as they are from the same call area. Your present callsign will appear on the award unless you request otherwise.

Mail your application to:

Amateur Radio Station W6LS
2814 Empire Avenue
Burbank CA 91504

Ten American Districts Award



0

Station Call	Frequency	Mode	Date	Time	S Report R



1

Station Call	Frequency	Mode	Date	Time	S Report R



2

Station Call	Frequency	Mode	Date	Time	S Report R



3

Station Call	Frequency	Mode	Date	Time	S Report R



4

Station Call	Frequency	Mode	Date	Time	S Report R



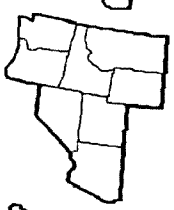
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Station Call	Frequency	Mode	Date	Time	S Report R



6

Station Call	Frequency	Mode	Date	Time	S Report R



7

Station Call	Frequency	Mode	Date	Time	S Report R



8

Station Call	Frequency	Mode	Date	Time	S Report R



9

Station Call	Frequency	Mode	Date	Time	S Report R

I have reviewed the QSL cards and hereby validate.

Station Call _____
Name _____
Address _____
_____

_____
Signature Call Sign

_____
Signature Call Sign

Mail to: Amateur Radio Station W6LS • 2814 Empire Avenue • Burbank, Ca 91504, USA

GLB TNC2A PACKET CONTROLLER

GLB Electronics - the first commercial producer of packet controllers joins the TAPR Revolution to bring you the GLB Model TNC2A Kit. This kit is the latest TAPR design and is supplied with top quality components. The GLB TNC2A is backed by over 14 years of experience in amateur radio kit products and our technical staff is available to assist you daily from 1 to 3 PM Eastern time.

GLB Model TNC-2A Kit

FEATURES

- AX.25 Version 2.0 Software
- Terminal baud rates - 300,1200, 2400, 4800, 9600
- Multiple connects - up to 10 stations
- Date/time stamping
- Standard DB25 for RS232 connection
- Simple radio hookup
- Radio modem w/built-in counter for calibration
- Low power CMOS option
- Tuning indicator socket for HF & satellite work
- Modem disconnect for future options
- Lithium battery backup for RAM



Hardware
Software
Documentation
by TAPR

Model TNC2A Kit NMOS $154.95
Model TNC2A Kit CMOS $169.95

SPECIFICATIONS

CPU	Z80A microprocessor
Clock	2.4576 Mhz standard, 4.9152 Mhz available
Memory	32K EPROM, 16K RAM standard
HDLC	Packets are controlled by hardware for maximum performance permitting full duplex operation
Modem	1200 baud, Bell 202 compatible (standard) easily configured for 300 baud/200 Hz shift for HF use
Serial	Computer/Terminal port is industry standard RS-232 C compatible for use with most equipment
Radio	Watchdog timer for channel protection transmits audio levels adjustable for nearly any radio. Wide dynamic range demodulator. Channel busy input (RF DCD) to inhibit packet transmissions on a shared channel
LEDs	Power: tells you when power is applied Status: tells you when you have unacknowledged traffic in your buffers Connect: tells you when you are in the error-free mode DCD: tells you when your TNC2A senses other activity on the channel PTT: tells you when your TNC2A keys the transmitter
Power	+ 10 to + 15 VDC (CMOS 110 ma NMOS 250 ma Typical)

Quantity discount schedule

1-2 pcs - net
3-4 pcs - 7%
5-9 pcs - 10%
10 & up - 15%

Shipping weight - 4 lbs.

17

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DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the October '86 issue must be in our hands by August 1st. Mail to *73 Amateur Radio*, WGE Center, Peterborough, NH 03458. ATTN: Hope Currier.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U. S. S. R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15[A]	10
ENGLAND	20	40					20	20		20	20	20[A]
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15[A]	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15[A]	10
SOUTH AFRICA							20				20	20
U. S. S. R.								20			20	

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U. S. S. R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

G=Good, F=Fair, P=Poor.

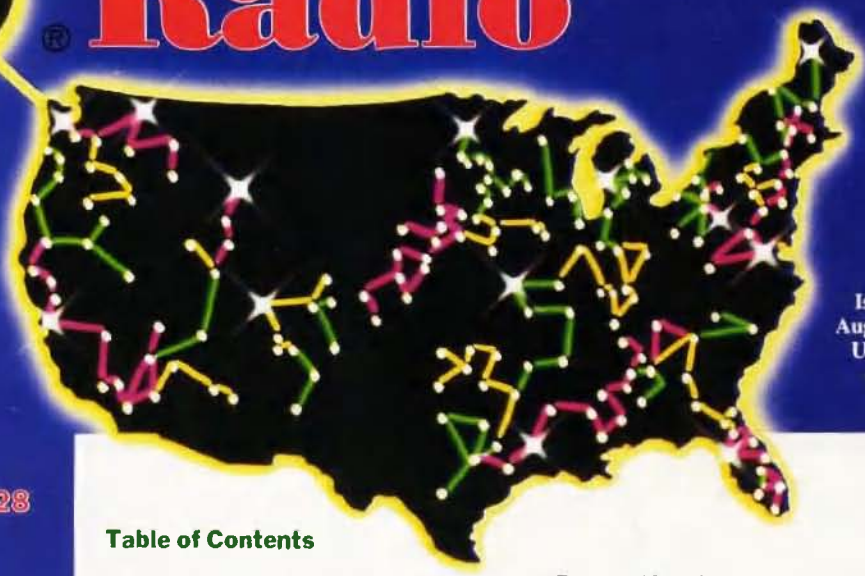
JULY

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 G	3 G	4 G	5 F
6 F	7 F	8 G	9 G-F	10 F	11 F-G	12 F
13 G	14 G	15 G	16 G-F	17 F	18 F-P	19 P
20 P	21 F	22 F	23 F-G	24 G	25 G	26 G
27 G	28 G	29 G	30 F-P	31 P		

73 Amateur Radio

A WGE Publication

SPECIAL PACKET ISSUE!



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August 1986
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•Mo
Di page 68
•Pa es page 58
•AX page 34
•Ne page 74

Build a Packet Tuning Indicator! page 40

plus:

Easy Connect Alarm page 66
Packet Buying Guide page 88
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A Packet Primer
For the totally bewildered—learn the mechanics of packet without having to ask embarrassing questions. W1BEL 28

How To Make Friends At 1200 Baud
Answers the question "What do I do with it?" that you asked after reading the primer. This article explains the operating side of packet W2JUP 34

Precision Packet Tuning
Complete plans for building what could be the world's best packet/RTTY tuning indicator. It's all digital and has a resolution of 10 Hz! . . . WB2OSZ 40

Seeing Packet Radio With Different Eyes
How a blind ham copes with an inherently visual mode. N7FDS 48

So You Want To Be A Sysop?
You may change your mind! Learn the secrets of a successful packet bulletin board station. WB2MNF 50

Birds 'N' Bauds
Amateur satellite builders from three countries discuss what's in store for packet radio in space. NK6K, JA2PKI, DK1YQ, DB2OS, DJ0HC/KE6MN 58

Connect Alarm!
A simple add-on for your TNC that screeches when someone connects to your station. This is a one-hour project (we're timing you!). K7YZZ 66

Survival Training For Mountaintop Digipeaters
The amazing story of a club with a purpose: to blanket the state of California with digipeaters. WB6RAL 68

Beyond Level Two
The philosophy of networking and the future of amateur packet radio. Read only after successfully completing pages 1-73. . . . . KA9Q 74

Lightning Never Strikes
These simple precautions can save your rig . . . or your life. W0WUZ 79

And If That Isn't Enough . . .
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At-a-glance comparisons of everything on the packet market (complete with prices). . . . . Staff 88

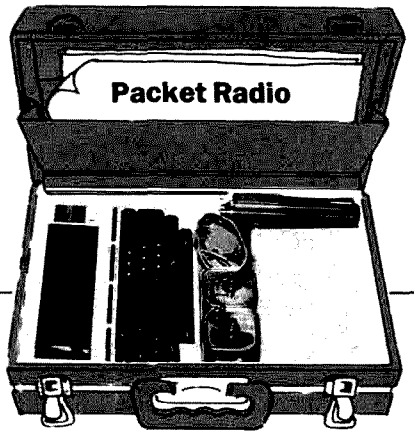
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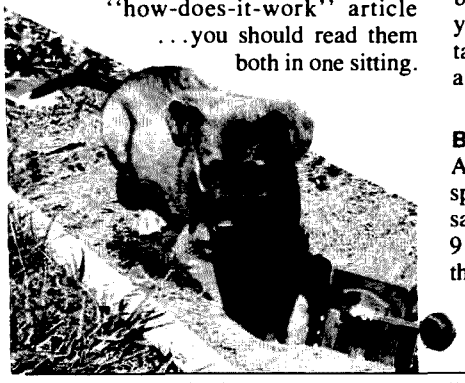
73 Amateur Radio®

AUGUST 1986 ISSUE #311

Have you heard about packet radio? Probably you have, but you are a bit fuzzy on the subject. Don't bother looking in the other ham rags for help. . . at best you'll find a rehash of some "See Packet Run" article. This magazine is a complete course on a single subject. We've done everything possible to cram every available scrap of information on packet radio into 112 pages: Some monthly columns were omitted, others trimmed down (they'll all be back in September). The result is a series of articles that will take you from knowing nothing about digital communications to pondering the intricacies of system networking.

A Packet Primer 28
We start our packet blowout with a close look at what packet radio actually is, laying the groundwork for the rest of the magazine. This is the nuts-and-bolts stuff, the ACKs and NACKs and frames that make everything work. Here is where you'll find out what a TNC does. (Admit it: You've heard about packet and would like to try it, but you're afraid to ask stupid questions. Well, now you can be Joe Packet without being embarrassed!)

How To Make Friends at 1200 Baud 34
Introducing humans (hams, at least) into a computer-controlled environment can get a bit tricky. W2JUP explores the etiquette of AX.25; what settings to use on your TNC and why. This is the "how-to-do-it" companion to the "how-does-it-work" article . . . you should read them both in one sitting.



Precision Packet Tuning 40
Did you think that there were no construction articles? John Langner's cooked up a tuning indicator for packet (RTTY, if you insist) that you won't believe. This gadget has a resolution of 10–20 Hz, needs no calibration, and lets you dead-eye a signal in about 10 seconds. It's easy to build, too.

Seeing Packet With Different Eyes 48
We've all heard about the effectiveness of RTTY for people with a hearing impairment. But what about the blind? Can packet work for them? Obviously it can, or we wouldn't have an article about it.

So You Want To Be A Sysop? 50
You may decide otherwise! If you *really* have your heart set on a packet bulletin board system, here's all the information you need to get one on the air. Beware: It takes more than a pair of disk drives and a TNC to run a BBS.

Birds 'N' Bauds 58
An excellent overview of packet radio in space, written by the men who built the satellites. Covered are UoSAT-OSCAR-9 and -11, JAS-1 (scheduled for launch at the end of July), and Phase 3C. (Phase 3C's launch has been delayed due to problems at Arianespace.)

Connect Alarm! 66
Another construction project—this time an audible connect indicator for your TNC-1 or TNC-2. If it takes you more than an hour to build, you should turn in your license.

Survival Training For Mountaintop Digipeaters 68
The true story of a club with a grand vision: To cover the entire state of California (where else?) with digital repeaters. Did it work? If we told you, you wouldn't read the article, would you?

Beyond Level Two 74
Don't turn to this treatise unless you thoroughly understand everything on pages 1–73. The subject is networking and the future of packet radio. Actually, the premise is that networking *is* the future of packet radio. Phil Karn leads you head first into the most controversial topic in ham radio since no-code licensing.

And If That Isn't Enough . . . 80
Just in case you've read this far and are still a bit confused (about packet, that is), take a deep breath and let Harold NK6K fill in the gaps.

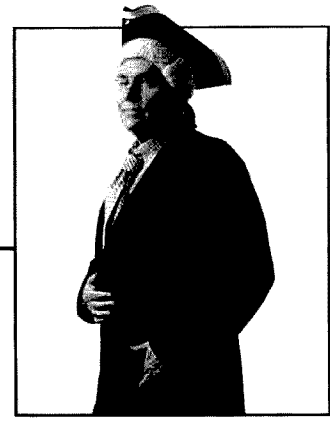
We'd like to publicly thank Harold Price NK6K for his work on this project. It is, in fact, Harold's issue: He assembled the authors, enforced the deadlines, and processed the manuscripts before uploading them to our computer. We couldn't have done this without him.—Eds.

"I never want to do this again as long as I live!"—NK6K

Extra copies of this issue are available for $4.50—send a check or money order to *73* Back Issues, WGE Center, Peterborough NH 03458-1194.

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NEVER SAY DIE



WANT TO DESIGN SOMETHING?

Presumably you've been horsing around with amateur radio for a while now. Okay, how much have you learned? Are you the kind of ham who made it courtesy of Dick Bash and hasn't made an effort to learn more? Or have you been working on your theory so you have more than a vague idea of what's going on in your rice box?

What could be simpler than to build a battery charger? Are you up to it, or is something as simple as that a mystery to you? Forsooth! Well, let me whet your imagination by explaining that in fact there is an enormous need for a battery charger. Indeed, if you could put just the right battery charger on the market I think you'd be able to sell millions of 'em.

Now, with that simple clue, can you describe the battery charger I have in mind? That's a test of your inventor's IQ. What kind of battery charger which (as far as I know) isn't available is so desperately needed it might sell in the millions? It's one you yourself have often wished you had.

Tsk, how am I going to make a real ham out of you? How am I going to help you to get rich when you're a lazy thinker? Haven't you any entrepreneurial spirit? Are you really going to spend the entire rest of your life calling in on the same net every night?

You've got NiCd batteries in your HT, right? If you're like me, you've also got 'em in your picocomputer, a portable disk drive, a bunch of toys, a cassette recorder, portable telephone, and so on. I've got a wide variety of NiCd chargers... keep 'em in a box on the closet shelf. But the big problem with NiCds...and I sure hope this isn't news to you...is that they must be completely discharged every now and then so they won't develop a memory and hold only a short charge.

Exercising all my NiCds is not something I tend to remember to do, with the usual result that I often find my HT fading away after a couple hours of work instead of lasting all day. Or I find the low-battery light blinking on my computer. Drat! Now why in hell doesn't someone make a NiCd charger which will do the exercising automatically every few days...maybe in the middle of the night?

Is that something that is technically beyond your competence? Yes, I know NiCds don't drop their voltage very much before suddenly dying, but they do drop enough so you should be able to measure it and come up with an intelligent NiCd charger/recharger. If this is too much for you, perhaps it's time for some serious thought about learning the fundamentals of electricity. It's really about time, isn't it?

Would you enjoy it if I found someone to get started with a course in *73*? Lordy, that could run for years, a chapter a month! If you're not serious about wanting to learn—if you'd rather not bother to know more about electricity and radio, okay. If I take the space—perhaps six pages a month—will you take an hour or so every month to read it and send in your homework?

One of the difficulties with learning electronics is the lack of any good self-teaching texts. Most textbooks are designed to be used as supplements for school classes, so they're more references than self-teaching books. The ARRL *Handbook* is fine as a handbook, but it's a ball-breaker when you try to use it to learn some-

Continued on page 10



"I know you need the extra space for ham radio...so my mother is moving out!"

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Disclaimer

OUR SHARPER READERS will notice that this issue of *73* is slightly different—we've devoted nearly every page to coverage of packet radio, this month's special topic. What a tough decision! On one hand, we had an entire magazine's worth of great packet articles. On the other, we had all of our regular columns and departments. In the background was the reality that there are only so many pages to put things on. Should we leave out important articles, or leave out the columns? We took a look at what the other ham rags were doing with packet. Pretty wimpy. So, we decided to go for broke (just a figure of speech!) and make this issue a packet instruction manual. Everything that you need to know about packet radio is in this magazine. Next month, all of your favorite departments will return as we take a look at the world below 30 MHz.

Reaching Out

MIKE NEARY, obviously a devout follower of QRX as well as the space program, mailed in the results of the National Space Institute's (now the National Space Society) **Space Outreach '85**. The program solicited ideas from the public as to potential uses of space; suggestions had to be made in 750 words or less. The panel of judges included Walter Boyne, Director of the Smithsonian's National Air and Space Musuem; Evert Clark, Technology Editor of *Business Week*; and former astronaut Michael Collins. Ten ideas were selected for awards, including one from **Patrick Gowen** of Norwich, England, who wants to put a radio beacon on the moon. (Mike Neary: "Personally, I'd rather see a repeater, but I guess you've got to start somewhere!") Other interesting projects in the top ten were an Earth/space television channel (an imaging satellite in a figure-eight orbit around the Earth and the Moon, sending continuous real-time pictures from space), a space ark which would carry the genetic codes of all life on Earth, and a Space Debris Collection System designed to clean up all of the junk floating around in low-Earth orbit. More than 1,000 ideas were presented to the Outreach panel; the collected entries were compiled and presented to the Congress, NASA, and the National Commission on Space.

Youngest YL?

WE HAVE A CLAIM on file for the title, "Youngest Licensed Lady." **Jill Kristine Dietrich KA9VGW** is five years old and recently passed her Novice exam with perfect copy on the Morse test and only one question missed in the written portion. Jill attends kindergarten in Bremen, Indiana. Her father, **Jeff Dietrich WB9ZHV**, says that Jill became interested in ham radio at the age of three, and that she also enjoys riding her bicycle, coloring, camping, playing with the piano, and playing with her three-year-old sister, who also shows an aptitude for the code. Jill's first contact was with KA0WGQ in Flatriver, Missouri, using a Kenwood TS-520S. Are there any challengers to the title? Let QRX know, and be sure to send a picture along.

Compu-Guide

EDITION 3.0 of *The DXer's Guide to Computing* is now available from Radio Sweden International. This is a 35-page manual that covers a wide variety of computer applications in the ham shack, including RTTY, packet, and computer control of receivers. I was really surprised to read that, while 55% of American hams own a computer (the number for *73* readers is close to 70%), *only 23%* of Japanese amateurs own one! (According to a survey taken by Japan's *CQ Ham Radio*.) The book is pretty thorough; you can get a copy by sending U.S. $3 to Radio Sweden International, S-105, 10 Stockholm, Sweden.

CQ Writers

IF YOU SPEAK ENGLISH, you could write for *73*. We are looking for columnists to cover every aspect of ham radio: EME, DXing, ragchewing, antennas (especially antennas!), slow-scan, fast-scan, satellites, or whatever. If you are active on one particular band, be the columnist for that band—we'll have a short column for 80m, 160m, and so on. . . all you have to do is report what's going on on your band. As a columnist, you'll have to send in about five double-spaced typewritten pages every month, plus photos and diagrams. If you want to give it a shot, make up a couple of sample columns and mail them in. If they're lousy we'll tell you they're lousy, but we'll also help you improve them. We also have our readers voting on all of the columns, so if in three or four months you're on the bottom of the heap, you're out of there. Think seriously about giving this a try. We'll pay you a little money—not a lot, but enough to help you buy some toys. Mail your sample columns to Perry Donham KW1O, *73* Magazine, WGE Center, Peterborough NH 03458. Good luck!

Haney Vo-Tech

THE HANEY VOCATIONAL TECHNICAL CENTER is looking for donations of ham equipment, books, and materials for use in a course on amateur radio. It looks as if the school system is allocating no money for the project (typical), so the classes will have to use whatever comes in. **Mike Adams N4EVS**, instructor for the course, points out that any item donated is deductible from your income taxes at the cost of replacement, no matter what the condition of the item is. In fact, Mike suggests that non-working gear would be great for practicing troubleshooting and repair. Once the program gets rolling, a complete ham shack will be set up at the school for the students' use. If you have an item that you would like to donate, drop Mike a postcard stating what you have, the estimated cost of shipping (the school will pick up the tab), and your phone number. Send it to Mike Adams N4EVS, Haney Vocational Technical Center, 3016 Highway 77, Panama City FL 32405.



Is Jill KA9VGW the youngest YL licensed?

Break the Bank

REMEMBER THE CASE of the bugged beads? The company that cracked that caper is back on the trail. . . this time they're after low-lifes who try to break the bank at casinos by using computer technology. **CCS Communication Control, Inc.**, has developed the CD-101 Computer Detector. Pit bosses run wire antennas down their legs and arms, and attach a control unit to their belt. Discreet alarms go off when the unit detects computer hash (I wonder if they get interference from nearby TRS-80s?). The security crew can dress and walk around naturally (or as naturally as they can get with wires running taped to their arms and legs), providing a very low-key guard against compu-cheaters. The price? *Only* $22,000.

Double Eagle

ASTATIC CORPORATION, maker of the famous D-104 microphone, has "confirmed the rumor" that a new mike is in the works. (Actually, the only rumor I heard was in a press release from Astatic.) The new model is the D-204, a scaled-down version of the lollipop that sports an adjustable preprocessor and the same chrome finish as the D-104. The new microphone will be marketed as the Silver Classic.

Lowfing

LOOKING FOR A REAL CHALLENGE? Why not try putting out a signal on 1750 meters? ***The Lowfer Letter***, published by **Hal Murken NQ2Y**, crossed my desk recently, and it looks as though activity on the band is beginning to gear up for the winter season. The 1750-meter band (160–190 kHz) is set aside for low-power stations under Part 15 of the FCC rules and regs; no license is required. There's a limit of one Watt output and a restriction on antennas and feeders (they can't exceed 50 feet), but a look at the list of beacons in the *Letter* indicates that activity on the band is growing. If you're interested, send Hal a few bucks and several SASEs; his address is 19 Hobby Lane, Oakland NJ 07436.

VE Two-Way

VE3CNE, the official ham station of the Canadian National Exhibition, will be on the air from August 13th to September 1st daily from 10 a.m. to 10 p.m. local time. The station is located in the Arts and Crafts Building east of the Dufferin gate, and visitors are encouraged to drop by and operate. Look for **VE3CNE** on the air according to this schedule (time is in UTC): Phone—3.790 at 0200; 7.250 at 1800; 14.180 at 1900; 21.250 at 2000; and 28.550 at 1700. CW—3.710 at 0230; 7.125 at 1830; 14.040 at 1930; 21.150 at 2030; and 28.150 at 1730. This operation is not to be confused with **VE7EXPO**, on the air through October 13th from the World's Fair of Transportation and Communication in Vancouver. VE7EXPO is on practically every amateur band and mode from 160 meters to 1.2 GHz, so you should have no trouble finding them.

The Shootist

THIS FROM JOE MOELL K0OV, via Bill Pasternak WA6ITF of *Westlink*: An armed man apparently in search of a clear television channel shot and killed a CB radio in La Habra, California. According to the police, Dennis Carrico was operating his CB radio when a man with a gun walked in, told Dennis to get out of the way, shot the rig three times, then walked away.

OARS Well

THE OLYMPIA (WA) AMATEUR RADIO SOCIETY is trying to stir up some interest in their **Worked OARS Certificate**. To qualify for this coveted award, OARS members must work 10 other OARS stations, western Washington hams must find 5 OARS stations, and the rest of the world need only work 3 stations. All bands and modes are valid, but there are no special endorsements to the WOARC. You also must mention during the QSO that you are working toward the certificate. Once you've worked your quota, send a 9" x 12" SASE to Certificate, Olympia Amateur Radio Society, PO Box 5582, Lacey WA 98503, along with a log showing the date, time, frequency, and the name of each contacted operator.

World View

STUDENTS AT LESTER PEARSON COLLEGE in Victoria, British Columbia, are getting a taste of the freedom of amateur radio. Pearson is one of five World Colleges sprinkled across the globe whose function is to bring together young people of many different nationalities. Pearson, whose president is *Prince* Charles, has students from 60 countries. The school runs an amateur station (VE7LPC) with equipment donated by the Victoria Kiwanis Club. Pearson has graduates all over the world, including JO1UKS, OA4BIK, C6ADG, PA3BEW, VE7FLP/5Z4, and the husband/wife team of OA4BBU and YV5HFF, who met each other at the club station. VE7LPC is sponsored by Ron Parrett VE7TG.

Thai Ones On

AMATEUR RADIO IN THAILAND is about to become legal. According to **Tony Waltham HS1AMH** of the *Bangkok World News*, ham radio was never really illegal in Thailand, but in the past had been officially sanctioned only for special events such as contests. There was, in effect, an "understanding" with the authorities. The Radio Amateur Society of Thailand has been working for quite some time to get ham activity officially recognized, and RAST officers and members of the government Post and Telegraph Department have worked out a draft of regulations for an amateur service in the country. It has only been a few months since the National Security Council stated that amateur radio is an activity "that is not detrimental to society." Three license classes are called for in the draft regulations, including a no-code VHF license.

Good News, Etc.

THE GOOD NEWS is that the AMSAT Phase-3C spacecraft has successfully completed thermal/vacuum testing at the Martin-Marietta facility in Denver. A few bugs surfaced and were corrected. During the tests, the first JL downlink QSO was conducted by **Rip Ripportella WA2LQQ** and **Karl Meinzer DJ4ZC**. Karl was on mode L (24 cm up, 436 MHz down), while Rip used mode J (2 meters up, 436 MHz down); the uplink frequencies were chosen to produce an identical downlink frequency. The bad news is the recent failure of the European Space Agency's Ariane-2 booster, the fourth failure in 18 launches. Phase-3C is scheduled to ride the maiden flight of the Ariane-4 rocket in November, but Arianespace has suspended all operations until an investigation of the Ariane-2 failure is complete. The rocket was detonated after its third stage failed to ignite, destroying the $55 million Intelsat V satellite on board. This catastrophe comes on the heels of the ill-fated space shuttle launch in January, the explosion of a Titan booster in April, and the crash of a NASA Delta rocket in May. The western world is basically without access to space. (A recent editorial on National Public Radio's *All Things Considered* suggested that we ask the Soviets, with their 90% efficiency record, to launch our satellites for us.) It now looks as though Phase-3C will be delayed until 1987.

Meanwhile. . .

ALL IS NOT SO GLUM on the satellite scene. By the time you read this, the first Japanese-built amateur bird, JAS-1, should be off the ground and into orbit. The launch is scheduled for 2030 UTC on July 31st. Information about the digital side of both JAS-1 and Phase-3C can be found in this month's article, "Birds 'N' Bauds," on page 58. (There's a story behind that title which deals with a bar in Dayton, Ohio, called "Lips 'N' Sips," but we'll save that tale for another time.)

Thanks

ANOTHER MONTH OF QRX comes to an end. I'd like to thank everyone who makes this column possible, especially Tony Waltham HS1AMH, Roy Parrett VE7TG, Jeff Dietrich WB9ZHV, Dona Wolfe N7HOE, Bill Pasternak WA6ITF and *Westlink*, Thelma Woodhouse VE3CLT, Larry Reid VE7LR, Hal Murken NQ2Y, Mike Adams N4EVS, Mike Neary, *Sweden Calling DXers*, and *Amateur Satellite Report*. Send your news items and photos to QRX, *73* Magazine, WGE Center, Peterborough NH 03458, and we'll do our best to get 'em in.

NEVER SAY DIE

from page 4

thing. It is better used for reference than for teaching.

If I don't hear from you about this I'll have your number.

Now, back to the NiCd exerciser—let's get to work and see who can come up with the most elegant design. It should be able to handle any given voltage. My NiCd chargers are in 3-V, 5-V, 6-V, 8.5-V, 12-V, and 25-V sizes. The 25-V charger is for a portable printer. Naturally I took the damned printer with me on a trip to Asia, but managed to forget the doubledamned charger. I shopped Akihabera in Tokyo from one end to the other looking for a 25-V charger. None at any price! And wouldn't you know the manufacturer used a small rocker switch on the printer which of course turned itself on in my suitcase so it arrived in Tokyo completely discharged. Phooey.

Let's see what you can come up with to sense when NiCds need to be recharged—then to completely discharge and recharge them. There should be some indication on the charger as to where you are in the cycle. Have you ever seen a NiCd charger which gave you the slightest hint as to how charged you are? That's ridiculous!

Now look here, you've been putting up with this NiCd nonsense as long as I have and you haven't made a move to do anything about it. How many of you dutifully discharge your NiCd packs every few days? How many of you keep a timer by your charger so you'll not overcharge? I don't even recall ever seeing a NiCd charger with a timer built in—and these damned things don't do at all well when trickle-charged.

You say that building a voltage-sensing chip into a charger is beyond you? That even building a timer chip has you in a panic? Say, we've got to get you going with some simple building projects and get your ham juices running. Back when we used to have lots of kids coming into the hobby, most of 'em weren't fazed by little things like that. Naturally, now that we have a geriatric hobby, we can't expect old people to be able to actually learn anything. Old brains are so totally frozen with bad habits that they're unable to learn even the simplest of new things... right? You can't teach an old dog new tricks you're telling me, right? Pant, pant.

The next time you're in a bookstore check the animal stacks and take home a Barbara Woodhouse book on training old dogs. It turns out they're not much more difficult to train than young ones. Just because you've spent the last few years avoiding the technical articles in the ham magazines doesn't mean you can't learn. It does mean you'll have to make do with less Tom Selleck and those brain-damaging sitcoms we use to keep our children stupid.

Speaking of children, the chances are that unless you've been working DX every night, you have some around the house. Take a check and see. Even if you've been DXing, the liklihood is that your wife hasn't, so there should be some kids around, even if they aren't yours. Ask about it when you get through reading this.

Let's see, with the average ham age now at 56 and rising, your kids must be around 34 or so. Hey, that means they probably have kids around 12—just the right age for exposure to amateur radio. If you do it right the infection will last a lifetime. It's incurable when properly set. I don't know your infallible system for spreading our common infection, but one I've found remarkably effective is the use of negative psychology. "Don't ever let me see you anywhere near Grandpa's ham rig." That's all it usually takes to create a situation they can't resist. Let me know what works for you.

If I got you thinking on the NiCd exerciser/charger, you may start looking for more gadgets to whip up. One thing we've been needing for years is a simple automatic ID system for our rigs. Yes, I know about the Morse-code ID we use with repeaters. I haven't run into anyone using one of those on his own rig. I don't expect to. If you run it slow enough so people can copy it, it's a nuisance. If you run it fast, no one can copy it.

Okay, you inventor-oriented readers should already have the new ID system almost designed. My approach would be to use a computer—probably a C-64, since there are so many of 'em and they're el cheapo if you don't have one yet. I'd then set up a 9600-baud clock and have the ID unit send out the code. Let's see, we'll need a protocol for this... need to come up with a format.

At 9600 baud how long will it take to send a six-character ham call... maybe eight if it's a portable... plus two for the state and two for counties? If you can't figure that out you're indeed in trouble. Using ASCII we have eleven bits per character... a start bit, eight for the character, one stop bit, and one for parity checking. So we need to send 132 bits. At 9600 baud... where bauds are bits per second... we'd be able to get that through the pipe in 14 milliseconds. That's just over a hundreth of a second. Heck, that shouldn't eat into our talking time too badly. Yes, I know there are some old-timers who don't even leave that much time between drawls.

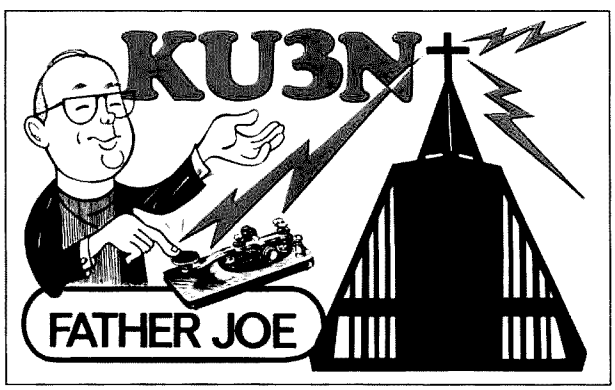
If our rigs were set so they'd send hundredth-second ID bursts, we'd be able to call CQ with these miniscule bleeps. We might even be able to type in the call letters of the station we're calling and send a double bleep, getting the establishment of a contact down to a 30th of a second.

The next step is obvious. Just think back twenty years to 99% of the contacts you've made. You've been saying exactly the same thing almost word for word for years. I know you have because I've been listening to you. I've heard you tell the other chap what rig you're using. Thirty seconds later he's forgotten, if he ever heard you in the first place. He also could care less what antenna you're using.

If he really wanted to know your name and QTH, he could look it up in his *Callbook*. So when it comes down to it, the only remnant of a contact a day or two later is the call letters. Signal reports? Come ON now! Just put down a 59 and forget it. The next time I print up some logs I think I'll just fill in the report column with 59s and leave a small extra column for dB over S9. That's the baloney column.

So if all we need from a contact is the call letters, we're moving right along. The next move is to get your rig to automatically find a clear channel and start sending periodic call bleeps. When the autotune receiver of another operator comes to your bleep, it'll respond with its call bleep... and you've got a contact once you acknowledge his call. Your printer should print out the QSL card for you on a continuous QSL form which you can tear off every day or so and send off to the bureau.

Your computer will log all the contacts, keeping track of counties, zip codes, states, ARRL countries, IARU countries, *CQ* zones, and ITU zones worked—printing out daily, weekly, monthly, yearly, and cumulative scores. You might want it to keep track of your fastest worked-all-continents time, too. Can we get that down



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

under one second without planning it ahead?

Your receiver can tune for the ID bleeps and show you the call on its screen. You can easily program it to call only specific prefixes. Hey, here's your chance to be the first ham to work one hundred countries in alphabetical order! It'll make checking for DXpeditions a snap. It might even make DXpeditions simple since the operator would no longer have to actually be there. You could just send the rig in a box—have someone put up a dipole, plug it in and turn it on. Low-life DXers might set their DXpedition rig up so only they could contact it. I know a DXer who fits that description perfectly... right, Frank? Are you still pulling those bogus rare DX cards out of your coat pocket at hamfests and club meetings?

The nice thing about this is we'll be able to get rid of the pileups. That'll be a disappointment to the 10-kilowatt crowd, those who get more joy from squashing dozens of DXers than from the contacts they make. By the way, chaps, pileups are absolutely illegal and you know it. I don't want to ever hear you sanctimoniously talking to anyone about rules and regulations if you ever get into a pileup.

You know the ham rules as well as I and it's illegal to create intentional interference. Is there any other name for plonking your signal on top of someone else calling a DX station? You know damned well there are others on the frequency, so you know full well you are as illegal as all hell. You know you are breaking the law... that you are thusly a creep and a scuzzball... unless I get the contact.

There's another invention for you. You sharp inventors have already figured out what I'm going to suggest. Let's see a circuit which detects a pileup on frequency and sends 1,000 volts at high amperage through the microphone to a steel plate in the operating chair if the transmit button is pushed. We'll get those pileups down to manageable size for me yet.

I don't know if 1,000 volts is enough. Maybe you can recommend some DX ops who should be recruited to check out the optimum voltage. It'd make a good article for *73*, right?

NEXT: MADE IN KOREA?

How long before we start seeing some ham gear made in Korea? With the plummeting of the dollar vs. the yen, the Japanese are busy moving production to Korea. You see, the Korean won is tied to the dollar, not the yen.

The Koreans are already busy flooding the U.S. with color TV sets and VCRs. Look for more and more consumer electronics to come from there... mainly from the two giant Korean firms, Samsung and Gold Star. Both of them are already in production on 8mm cameras and VCRs, so they're not seriously lagging in technology... which they've been buying from Japan, there being very few Korean engineers or technicians.

Being so close to Japan, the Koreans have been hiring Japanese engineers and technicians to fly over on weekends to moonlight. The Koreans, by not encouraging amateur radio for youngsters in Korea, have gotten themselves in the same fix we have... they haven't the needed technical people. They're fortunate to have Japan close by so they can import the needed talent on weekends... we're too far away, so we're just plain up the creek.

If Japan isn't careful they could end up losing all of the consumer electronic industries to Korea... and with them would go the whole supporting infrastructure of parts manufacturing. Indeed, this has been rapidly moving to Korea, too. You know, even if we could scrape enough engineers and technicians together to get consumer electronics manufacturing going in the U.S., we no longer have the parts we'd need... the resistors, capacitors, transformers, coils, circuit boards, and so on. Most of the firms making those went the same way our American manufacturers did... pffft.

No, we don't have amateur radio to blame totally for this debacle. The American tax structure did its part to destroy investment here, too. When I was interested in building a product to sell in Europe I priced making it here and shipping it over vs. making it there. I found that if I wanted to invest $250,000 in a plant here to make the product I'd first have to earn a second $250,000 and give that to the IRS in taxes. If I wanted to set up exactly the same plant in Ireland I found I'd only have to send over $125,000. Ireland would then match it... help me find a good manufacturing site... and pay to train workers or even pay to send them to the U.S. for training. The bottom line was that I'd get four times the bang for my buck by opening a plant in Europe ...plus I'd have further tax advantages from manufacturing in a Common Market country... and a tax holiday for several years in Ireland. You can see how our tax situation drove a large part of our manufacturing out of the country. I formed an Irish branch of my company, just as did Apple, Memorex, and many other U.S. firms. It's the people who write dumb tax laws who are the problem, not the businessmen who prefer to avoid them.

Smaller firms aren't equipped to handle an overseas branch, so they either make a go of it in spite of the tax situation... or don't. Our shortage of engineers and technicians has hurt this group the most, virtually eliminating them as competition.

This is not a new situation. Over ten years ago, when FM and repeaters were just getting up steam, Standard Radio was our largest ham gear supplier. They made HTs, mobile FM rigs, and even repeaters. Indeed, it was a Standard repeater I took over to Amman and set up as JY73 back in 1973 on .34/.94.

When I visited the Standard sales offices in Los Angeles I found the service department was made up almost entirely of Japanese hams. They'd given up on finding American technicians, so they'd had to bring Japanese hams over.

I've tried to interest the Koreans in using amateur radio as a way to develop more of their desperately needed engineers and technicians, but the political situation there is a difficult one. Perhaps, if we're able to get enough hams for a DXpedition to Seoul in October, we'll be able to get 'em more interested in developing more Korean amateurs.

If you do go on the trip I think you'll have an opportunity to see one of the most modern, highly automated electronic factories in the world. We'll see if they start getting into making ham gear as well as other consumer electronic equipment... and cars.

BETTER HAMFESTS

Perhaps there is a need for a hamfest organizer's newsletter. I see innovative hamfest ideas here and there, but on the other hand I see some hamfests which sure could use major consulting from an expert. Having probably been to more hamfests than any other living ham, I'll get the ball rolling here with some ideas. Lordy, I've been to hamfests all around the world! Here are some random thoughts you might pass along to your next hamfest committee:

There are four general groups you want to attract and each requires a different pitch. First come the industry people for the exhibit area. Second are the flea marketers. Third are the local hams. Fourth are the hams from up to about 200 miles outside the local area.

The industry people who are most important to you are the ham dealers. Of secondary importance are manufacturers, which includes the magazines. You'll increase the industry exhibits by emphasizing the quantity and quality of the attendance... but don't be tempted to exaggerate it... most of us have been to enough hamfests to be able to make surprisingly accurate estimates. You have to let industry people know a year ahead so they can set their plans. And please, don't have your hamfest conflict with another major hamfest!

Since most industry people come from afar, be sure to let them know about any nearby attractions such as theme parks. You might also make up a special map showing the location of restaurants and shopping areas ...perhaps with some recommendations. This will help out-of-town ham visitors too.

You might arrange for an exhibitor meeting on Friday night. Provide a meeting room and refreshments. Also, even if you have to increase the booth price a bit, consider having an exhibitor lounge with some coffee and snacks in the morning and sandwiches for lunch so they don't have to get on the chow lines and waste valuable sales time to get food. Coffee and doughnuts in the a.m. are greatly appreciated. Dayton has a separate exhibitor's lounge. Orlando and Miami provided nice exhibitor lunches.

You might include brochures for local attractions in your mailings. That might get out-of-town industry people to bring their families and come a day early or stay a day late—and help bring 'em back again next year.

Have you thought to have someone go around to take pic-

Continued on page 107

LETTERS

OPEN REPLY

Richard Baldwin W1RU
President, IARU

I have read with great interest and considerable dismay the "open letter" addressed to you by Herbert Schoenbaum KV4FZ published in the May, 1986, issue of *73* Magazine. As Net Control for the Caribbean Maritime Mobile Net (7082.5 kHz, 1100 UTC to 1200 UTC daily), I feel I must take considerable exception to KV4FZ's across-the-board condemnation of cruising yachtsmen who are also hams.

Mr. Schoenbaum is completely in error that "cruisers" do not feel it necessary to obtain reciprocal licenses in foreign ports. In my experience, the vast majority do obtain such licenses, and are well aware of the necessity for doing so. We have files of information available to facilitate this licensing, and are frequently asked for it. Certainly, there is a small minority [of yachtsmen] who do not accept the concept and operate illegally. These are soon eliminated from our net operations, if there is any question at all. I just wonder how Mr. Schoenbaum obtains his alleged information on these so-called "illegals" or "pirates." He currently resides in Ohio!

Further, if a cruising yacht obtains a C6A reciprocal or any other and takes a few days' cruise away from that jurisdiction or waters, then returns, it is certainly not only legal, but required that he use his U.S. callsign aboard his U.S. registered or documented vessel while in international waters. On his return to the port where his reciprocal license was issued, he must again, of course, use that callsign designation. A case in point—the British Virgin Islands are only 40 miles from St. Croix. Boats going to the BVI use their U.S. callsigns en route, then obtain a BVI VP2V reciprocal on arrival and use it in BVI waters. They can cross over and back many times, using their U.S. call en route and their VP2V recip. while in BVI territory. That recip. is good for one year, whether in BVI waters or not.

Mr. Schoenbaum's allegations that cruising yachtsmen only use their ham radio to make phone patches is ridiculous. I have managed my net for about two years, taking up to 30 daily check-ins, and doubt if I've been asked to make over a dozen patches in that time! Those who do ask for and make patches are usually in areas where there is no phone service, or it is poor at best.

And his contention that "cruisers" seldom get on the air on the high seas in true international waters is a complete falsehood. I cannot count the number of "Maritime Mobiles" I've passed traffic for and given weather information, port information, etc., to, who are en route from the Azores, Canaries, or from here to Bermuda, the Panama Canal, etc. Further, a large part of our "cruisers" seldom get on their radios in port, as, rather than "luxuriating" in a foreign marina being entertained, they are too darned busy working on their boats and, yes, even working at jobs. Mr. Schoenbaum seems to feel that all yachtsmen are wealthy idlers, and this perhaps has led him to zero in on them from pure envy of their lifestyle!

I have met personally many, many of these folks, and have found them all fully aware of, and accepting of, the legalities of the use of ham radio aboard their boats and in foreign ports. A large portion were hams long before going sailing.

We provide a service, the name of the game in amateur radio, and have been directly responsible for saving lives and property, locating overdue or missing vessels, providing local navigation information, and so on.

KV4FZ, whom I've known personally for about 10 years, is an extremely knowledgeable electronics expert. I seriously doubt he has ever set foot on a blue-water cruising yacht for a real cruise. Therefore, I feel he should confine his expertise to electronics and refrain from his Quixotic zeal in chasing "pirates" and interfering with the operations of the various Maritime Mobile Nets!

Louis K. Bean KV4JC
St. Croix USVI

I'm really tired of hearing the constant bickering between KV4FZ and the Maritime Mobile Net. It's been in and out of the ham magazines for years—always the same accusations, always the same indignation. You want trouble? Let's talk about the taxi drivers in New York using two meters. Let's talk about the contras *in South America running around with their IC-02ATs. Who cares if a couple of yachtsmen use 20 meters for phone patches? At least they're hams.*

There are more important things to worry about than whether a ham is where he says he is. You guys seem to forget that ham radio is a hobby, *not a religion. Until someone comes up with something intelligent to say, you'll not see another word on the subject in* 73.*—KW1O.*

DIGITALIS

I like the proposal for a digital-radio service. Ideally this should be part of ham radio, but it can never be due to the emotional issue of Morse code. If this service had been available three years ago, I would have never gotten a ham ticket.

Earl Morris N8ERO
Midland MI

That's exactly what the opponents of the Public Digital Radio Service are saying. Although amateur packet radio and the PDRS are fundamentally different, most people would flock to the "no-code" PDRS, leaving ham radio in the lurch.

Believe it or not, we have another shot at a no-code amateur license. It looks as though the Novice Enhancement proposal will be approved—once it is in place, we'll put on the pressure to drop the 5-wpm code requirement from the Novice license.

No-code is far from dead—the FCC is in favor of it, the ham manufacturers are in favor of it, and you and I are in favor of it. The crucial missing piece is the Board of the ARRL, and I have the feeling that with sufficient pressure from the membership of the League, the Board would endorse a no-code license. Remember, Earl, that ARRL Directors are basically politicians, and politicians have been known to change their minds.—KW1O.

TECHNOFLUBS

My career is electronics, for which I have always had a spiritual love. I owe most of my success to ham radio; electronics education in America is disgraceful! My high school friends and I started an informal club to teach ourselves electronics (in the late 50s) because there was no other way to learn it.

We were denied permission for a ham station at school. The attitude there seemed to be, "We, the intellectual elite, don't understand electronics; therefore, it is irrelevant." We were reduced to conspiracy—having gotten the runaround after requesting nicely that the school library subscribe to *Popular Electronics*, we mailed a subscription form in the school's name, checking the squares marked 5 YEARS and BILL ME LATER. It worked!

It's impossible to learn anything in the public school system that leads to occupations better than teaching. If teachers knew such things as electronics, they could get real jobs! The back half of my high school physics book was filled with good electronic stuff, but the teacher never reached it.

I expected to learn "real" electronics at a state university's engineering school, and was badly disillusioned by a faculty of frustrated physicists and mathematicians with no practical experience. Several of them could not speak understandable English. The prevailing educational theory there was, "If you know all of the generalities, you can derive all of the specifics." More academic elitism! Though I managed to graduate, I feel that most of my time was wasted. The most useful knowledge I gained in college came from ham radio, through association with the university's club station.

Professional educators apparently still espouse the effete and fraudulent theory that a teacher doesn't need to know the subject matter, but only how to teach. My city has a fair amount of electronics industry—a local high school grudgingly offered a basic electronics course, employing a teacher who attempted to explain the "shematic" diagram of a "superheat" receiver.

There are still a few excellent technical institutes staffed by real electronics people instead of "educators." Is the dwindling number of young hams any surprise, when high school students are advised by teachers and peers that a technical education isn't a "real" education, and that engineering is bad because engineers design

weapons? Does Japan have such a problem?

Name withheld

I spent a year in the Electrical Engineering department of a large eastern university, and was sickened to see senior EE students who couldn't tell the difference between a capacitor and a resistor. They could solve equations and even design circuits using resistance and capacitance, but they had no practical experience at all. One day, I stood quietly and watched while two graduate students attempted to solder a transistor to a printed-circuit board—without solder! They were trying to melt the leads.

I'll bet that in Japan things are not much different. I realize that every child in Japan is taught electronics in school, and I recognize the preeminence the country has in the electronics industry. In America, every child is taught mathematics in school. Are we a country brimming with mathematicians? Of course not.

Two things account for Japan's success in the electronics industry. First, the Japanese are extremely good at copying other people's technology. Second, the Japanese government and the industry work side by side to make certain that they remain on top of the heap. The result is that electronic products are made with a higher quality and a lower price than we can ever hope to achieve. Improving our technical education is useless unless we can also bring production costs down to a reasonable level.

It's crazy to buy American products just because they're American; I refuse to pay twice as much for a product half as good as what I can get from overseas.

By the way, why did you want your name withheld? Are you still hiding from your high school librarian?—KW1O.

10 METERS OR 11?

The recent tragedy on Mt. Hood, where nine teenagers lost their lives, prompted some thoughts on how ham clubs could help to prevent such occurrences. Not by providing emergency communications after the fact, which is done now, but rather to interest climbing club members, who are mostly young people, in getting ham licenses so that they would always have communications with them during their climbs.

There are a number of occurrences of lost hikers and climbers each year in the Pacific Northwest, and I am sure that it happens throughout the country. These events cost a substantial amount of money in terms of rescue activity, to say nothing of the risks taken by rescue personnel.

It seems to me that it would be an excellent project for a ham club to acquaint climbing and hiking clubs with the wonders of having amateur radio with them on excursions to the wilderness. There may be thousands of new, young recruits for the ham ranks to boot.

The main activity, as I see it, would be to tell climbing clubs about VHF and repeaters, and the natural combination of mountain-climbing and ham radio. The emergency aspect is a bonus. Could this be another incentive for no-code exams in the VHF and UHF bands?

I am challenging a local club to start something along these lines and I would request, since you have been prodding clubs to get going on new recruits, that you could make a similar challenge on a national scale. How about it?

Niel Classon W7NYB
Renton WA

I hate to say it, but you would be better off telling the clubs about CB. Their public-service record is just as good as ours, and there are about ten times as many CBers as there are hams. There's even a national CB emergency channel, something we hams haven't thought of.—KW1O.

AM-ATEUR RADIO

One of the main reasons that yours and other fast-buck ham magazines ignore AM is that there is *no money* in it for you—no big, glossy ads. You cater to the bucks, and the Japs have them.

Heaven forbid! If too many hams started using AM, it would cut down on your business. After all, most AMers are running old junkers 25–30 years old. That's not the worst of it: Supposing, horror of horrors, that new hams and others started building AM transmitters from old black-and-white tube-type TV sets. It would be disastrous—for your business, that is.

So please, spare us all that crapola about the state of the art. AM phone is still an efficient and effective means of communication. We know you are mainly out for the payola.

Fred Huntley W6RNC
Nevada City CA

What, you mean there's money to be made in ham radio? Get with it, Fred, AM is about as efficient as spark. I suppose when CW came around, there were still a few spark-forever fanatics who clung on to the very end, and that's the way it will be for AM.

If AM is so hot, why isn't anyone writing about it? We don't toss AM articles into the garbage; we don't get any AM articles. The reason is that ham radio has moved on. . . if you're stuck in the hobby of 40 years ago, I feel sorry for you.—KW1O.

LEND ME UR EAR

Your editorial about the proposed Electronic Communications Privacy Act (ECPA) was to the point, as usual, but didn't tell your readers what to do about it. Calling your Congressman's office and just leaving your opinion with a receptionist doesn't help. You have to get through to the decision-makers.

I called my legislators and asked to speak with the staff member responsible for communications issues. These staffers are responsible for reviewing pending legislation and often determine how a legislator votes on an issue.

In speaking with these staffers, I found that none had read the bill, and only one had a vague idea what it was about! After explaining what the bill was (I had called a Senator in January to ask for a copy of the proposal, which I promptly received), I ran through my list of objections. All three staffers seemed interested in my objections. Letters were sent to the three reiterating my conclusions. I tried to be as logical and objective as possible—emotional pleas just won't work. Representative Judd Gregg seems to have changed his position, and Senator Gordon Humphrey appears now to understand the issues.

I'll bet that my communications about ECPA are the only ones received by these legislators. As such, they will carry a lot of weight. The key is to effectively communicate with the decision-makers in government. You must speak with the proper staff member and follow up your conversation with a letter. We can have a large say in legislation if we just influence the right people.

Peter M. Bealo WB2MJG/1
Salem NH

SUB CW

While I was reading Never Say Die in the April issue of *73*, I was somewhat surprised, or should I say impressed, to learn that Wayne does scuba diving. I have been diving for only five years, but have enjoyed amateur radio for more than 30 years. I hold an Extra-class ticket and a Master Diver Trainer (instructor) certification.

As a diving instructor, I offer a specialty diving course entitled Underwater Communications Using International Morse Code. In the course I teach CW up to five wpm and the different ways to use CW underwater, and I encourage my students to go on for their Novice license (the course material includes a ham license manual).

The marriage of diving and amateur radio is becoming very popular with the course members. It is drawing the divers into ham radio and the amateurs into diving.

A side benefit to all of this is that when I take a group of divers to the Caribbean each summer, I have a ready-made group of hams to make a mini-DXpedition. As you well know, what could be more exciting than a dive trip and DXpedition to some exotic island? This kind of excitement is most appealing to the age group the diving industry is trying to attract—the age group that amateur radio needs.

This may be a small contribution to make to solve the problems confronting amateur radio and its lack of growth, but for the past year the local radio club and Novice class has produced no new hams. During this same time period my classes are getting the attention from the would-be hams.

There are all kinds of possibilities for the future, maybe an international club of some kind for amateurs who are also active divers to promote diving trips and DXpeditions. Maybe a net to discuss different diving activities; the next best thing to diving is a good ragchew about diving!

Bill Wheeler K0DEW
Lebanon MO

NEW PRODUCTS

AEA PK-232 MULTIMODE CONTROLLER

The Pakratt™ model PK-232 multimode controller is now available from Advanced Electronic Applications. The PK-232 is a complete Morse/RTTY/ASCII/AMTOR/packet terminal unit which interfaces with any computer having an RS-232 port.

A front-panel switch allows selection of one of two radios for easy HF/VHF selection, and a discriminator-style tuning indicator is included. Twenty-one indicators monitor mode and status.

The PK-232 retails for $319, and will be available August 1st. For complete specifications, please contact *AEA, PO Box C-2160, Lynwood WA 98036-0918.* Reader Service number 163.

YAESU FT-767GX

Yaesu USA has introduced the FT-767GX HF/VHF/UHF multimode transceiver. The FT-767GX comes equipped for HF operation, and optional modules are available to extend coverage to 6m, 2m, and 70 cm. The rig outputs 100 Watts on CW, SSB, AM, FM, and FSK.

Factory-installed features include an automatic antenna tuner for 160–10 meters, a CW filter, an electronic keyer, a speech processor, a digital wattmeter/swr meter, and a dual-vfo tracking system for OSCAR or repeater operation.

The FT-767GX is priced at $1,759.95; modules for 2m and 6m are $169.95. For complete specifications, contact *Yaesu USA, PO Box 49, Paramount CA 90723-0049.* Reader Service number 152.

CUSTOM KNOBS

Custom-printed knobs and dials are available from Selco Products. Virtually any logo, numeral, symbol, or line can be printed with a character height of as little as 1mm. A wide variety of shapes can be printed on, and it is possible to print lines around a corner. Knobs and dials come in black, gray, white, and clear, and can be overprinted in a variety of colors.

For more details and samples, contact *Selco Products Co., 7580 Stage Road, Buena Park CA 90621.* Reader Service number 153.

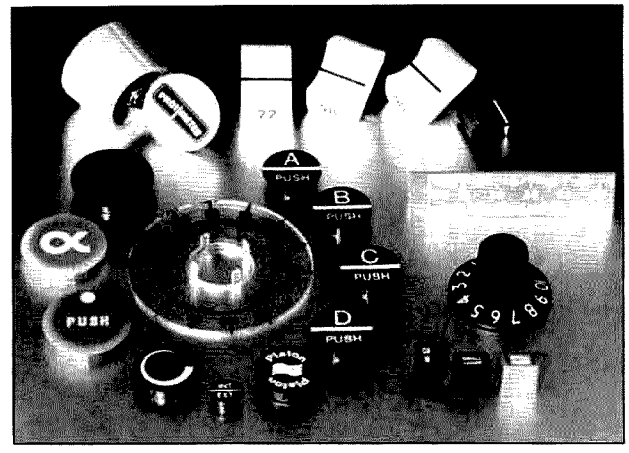
NEW MERCER DMM

Mercer Electronics, a division of Simpson, has introduced the model 9370 autoranging digital multimeter. The 9370 measures up to 1,000 V dc in 5 ranges, up to 750 V ac in 4 ranges, up to 10 Amps in 2 ranges, and up to 2 megohms. A memory mode stores a zero offset of 99 counts. Also included is an audible continuity tester.

The model 9730 retails for $59. For more information on the entire line of Mercer test equipment, contact *Mercer Electronics, 859 Dundee Ave., Elgin IL 60120; (312)-697-2265.* Reader Service number 158.

ICOM IC-48A

The IC-48A 440-MHz compact mobile transceiver is now available from ICOM America. The IC-48A covers 440–450 MHz with an output of 25 Watts. Features include a large LCD with auto-dimmer, and 21 scannable memory channels. For more information, please contact *ICOM America, Inc., PO Box C-90029, Bellevue WA 98009-9029.*



Custom printing services available from Selco.

JOHNSON CHALLENGERS

The E.F. Johnson Company has introduced a new series of VHF/UHF mobile radios. The Challenger™ UHF mobile (15 Watts) and VHF mobile (20 Watts) come with eight synthesized channels and programmable priority scan. The Challenger Plus™ UHF mobile (30 Watts) and VHF mobile (40 Watts) feature 19 channels and dual priority scanning. Both Challenger models offer multi-tone Call Guard™, multi-code digital Call Guard, a timeout timer, a monitor, and a user-programmable scan list.

For complete details, contact *Diversified Energies, Inc., E.F. Johnson Company, 201 South Seventh Street, Minneapolis MN 55402.* Reader Service number 156.

8-POLE CRYSTAL FILTERS

International Radio now has 8-pole crystal filters available for the Kenwood TS-440 and the ICOM IC-751, IC-751A, IC-730/740/745, R-70/71, and IC-271/471/720/720A. Prices range from $60 for individual filters to $150 for a 2.1-kHz matched SSB crystal set.

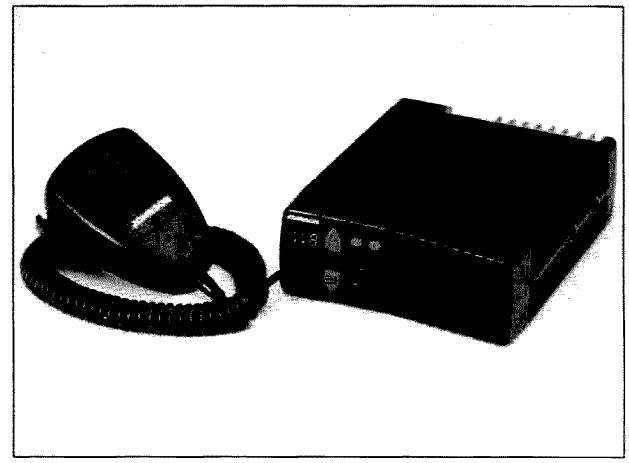
For a brochure describing these and other products, send an SASE to *International Radio, Inc., 747 South Macedo Blvd., Port St. Lucie FL 33452.* Reader Service number 157.

MOBILE CATALOG

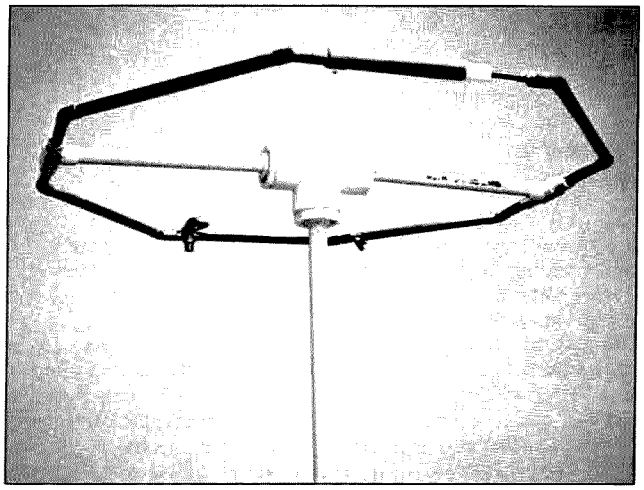
A 56-page catalog of mobile antennas, portables, and accessories for the mobile market has been published by Antenna, Inc. Complete mechanical and electrical specifications are offered



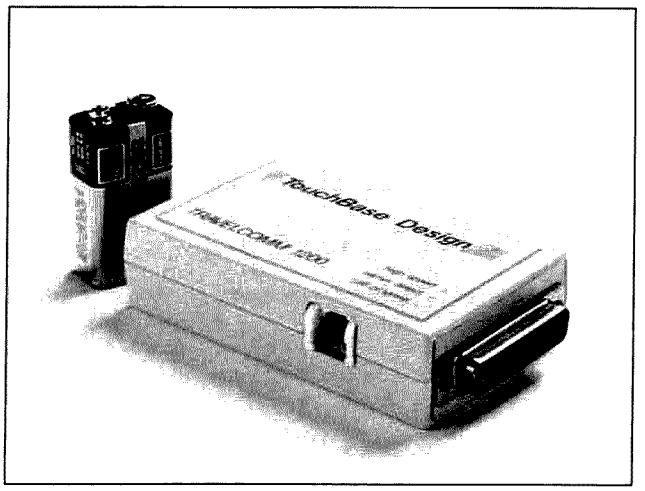
The ICOM IC-48A.



E.F. Johnson's Challenger™ VHF/UHF mobile radio.



Advanced Design Network's Microloop antenna.



The TravelComm 1200 portable modem marketed by Technigroup.

for antennas covering 25–1,000 MHz.

To receive a copy of the catalog, write or telephone *Celwave, Route 79, Marlboro NJ 07746; (201)-462-1880.* Reader Service number 159.

MICROLOOP ANTENNAS

Advanced Design Networks has announced their Microloop series of small HF antennas. Across-the-loop dimensions range from 27 inches for 10 meters to 104 inches for 40 meters. The antennas may be mounted horizontally or vertically, and can handle 200 Watts PEP.

A six-page overview of Microloop design concepts and installations is available by writing *Advanced Design Networks, Inc., 8601 66th Street North, Pinellas Park FL 33565.* Reader Service number 154.

APPLE TEKDRAW

Tekdraw, a graphics software package for the Apple *II* family, is now available from Computer Aided Instructional Systems. Using Tekdraw, you can design schematics, circuit boards, architectural layouts, certificates, charts, graphs, and so on. The Koala Pad, a joystick, or game paddles may be used as the input device.

The system includes predrawn symbols which can be selected, rotated, and positioned on the screen. Tekdraw will save, recall, and print your designs.

The software package, including a graphics utility section, sells for $69.95. For more details, contact *Computer Aided Instructional Systems, Box 177, Building 5, Service Drive, Holly MI 48442.* Reader Service number 161.

TRAVELCOMM 1200™

Technigroup, Inc., has announced the TravelComm 1200 portable modem. Designed for use with portable computers, the 300/1200-baud modem operates for about thirty hours on a 9-volt battery (included). Connection to the computer is made via a DB-25 (RS-232C) connector, and an RJ-11 modular phone jack handles the telephone line (a phone cord is provided with the modem).

For further information, please contact *Technigroup, Inc., 16 Green Acre Lane, Northport NY 11768; (516)-261-0423.* Reader Service number 162.

MIRACLE RODS

Miracle Rod of Glasgow, Kentucky, now offers a low-temperature brazing rod for aluminum. The fluxless rods may be used with a propane torch to repair breaks in antennas, to braze cavities, and to weld joints as simply as soldering. The rods have a high conductivity, and melt at 730–740 degrees.

For complete information, please contact *Miracle Rod, PO Box 791, Glasgow KY 42141.* Reader Service number 160.



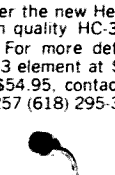
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For more details or to order the Heil HC-3 element at $19.95, the HM-5 SSB Mic at $54.95, contact HEIL, LTD., Marissa, IL 62257 (618) 295-3000 (add $3.00 shipping).



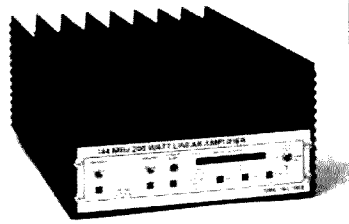
Hams who care about maximum results in getting over, around and through DX pile-ups now have another weapon in their arsenal. The Key Element!

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Ampro Little Board

by George M. Ewing WA8WTE/4

Ampro Computers, Inc.
67 E. Evelyn Ave.
Mountain View CA 94041
Ampro Little Board™—$249

There is a phenomenon in a rapidly growing and changing technology like personal computers that is usually called the "price knee" or "crossover point." This is a point in time in which the price for an older generation of machines is dropping quickly, and the cost of the new generation, initially fairly high, is also starting to fall. At some point, the cost-effectiveness ratio crosses over, and the new technology becomes cheaper and better than the old, even though the price of the old may be falling faster.

At some time in the last year or two, we appear to have reached that point with 8-bit CP/M computers. The older machines, such as the Heath H-89 and others that use the 8K 4116 memory chips plus large numbers of TTL and LS-family chips, are being replaced by newer machines designed from scratch to take advantage of the more efficient 64K DRAMs, custom LSI, and other technologies that lower the chip count and reduce power consumption. Of course, the stiffest competition is actually from the rival 8086/8088 and 68000 CPU families, but even within the CP/M world, things are changing fast.

Why a CP/M machine? There are a tremendous number of inexpensive or free public-domain programs available that are of interest to the amateur, everything from elaborate RTTY and logging programs to those for circuit analysis and filter or antenna design.

A good friend of mine, Jeff KB2JN, had been planning for some time to get an inexpensive CP/M computer to supplement his IBM PC and other personal and home machines. He looked at a number of options, including a used Heath H-89 or H-19 upgrade, an Apple with 80-column and CP/M cards, a Commodore 128, or the possibility of building up a system using a surplus Xerox 820, Big Board, Kaypro, Televideo, or Osborne board. After much deliberation, he decided instead on the Ampro Little Board, and I agreed to help him put his system together despite my built-in prejudice in favor of Heathkit/Zenith products. The rapidly dropping price of the Little Board, coupled with its simplicity, small size, and relatively low power consumption, made it look very promising.

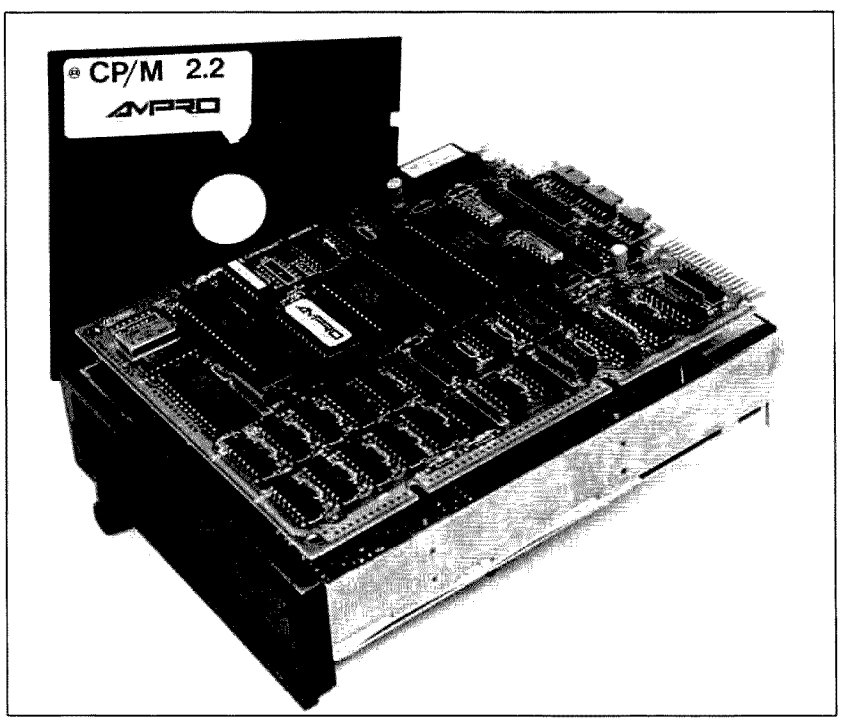


Photo A. The Little Board Plus, which includes an SCSI interface.

Equipment Needed

The Ampro Little Board (this discussion is only about the Z-80A CP/M machine—Ampro also makes a 16-bit MS-DOS Little Board) is designed to fit in the same physical footprint as the PC board for the typical 5-1/4" disk drive, and to be compatible with the same voltage and power requirements. The power connector is even the same edge connector that most drive manufacturers use. This makes packaging a homemade Little Board system a snap; almost any surplus drive enclosure or larger terminal will do.

A sheet of surplus 1/2" acrylic plastic picked up for a dollar at the Rochester, New York, hamfest flea market was adequate as a base plate for Jeff's ham-shack system, since we intended it to spend its whole life in the same spot on a shelf. For a system that is to be moved around, a surplus drive enclosure or one of the low-profile metal cases sold for IBM or Apple clone builders is fine, or the board can be mounted with a little effort in most terminal enclosures. The small size and low power consumption (and less resulting heat) make this a good option.

Besides a cabinet, the Ampro builder needs a power supply, 5-1/4" soft-sector disk drives (up to four), and some kind of RS-232 serial terminal to act as a console. (Unlike the Xerox-820 and Big Board, the Little Board requires a separate full terminal instead of just a keyboard and monitor.) All these items are available at reasonable cost; check surplus and mail-order catalogs and the ads in ham and computer magazines. We decided to use a surplus IBM 60-Watt power supply, perfectly adequate for the Little Board and a couple of drives. These supplies are widely available and a real bargain right now, as thousands of IBM freaks are pulling them out of their PCs and replacing them with heavier supplies for a hard-disk upgrade.

We selected two full-height 40-track drives, as the full-height drives are usually cheaper than half-height, and space was no problem with our layout. If you're going to stuff a couple of drives into a Heath H-19 terminal case or build up a briefcase portable RTTY machine, half-height drives might be worth a few extra dollars in saved space. If you're operating battery portable, the newer half-height drives may also use a little less power.

If the power supply you're using doesn't already include a cooling fan, putting in one of the smaller, quieter muffin fans is good reliability insurance. The thermal design and layout of your enclosure will determine if it's absolutely essential, but it's silly not to include a

fan except in the most extreme low-power, battery-operated briefcase designs, where every Watt-hour is critical.

For a terminal, Jeff decided for the time being simply to use his existing IBM PC in terminal mode with a public-domain communications program. If you don't happen to have an IBM PC lying around, another possible option is to use an inexpensive home computer such as an Atari or Commodore, with a serial port configured as a terminal. New Atari 800XLs were going for $39 or 3 for $99 in local toy stores around Christmas last year! Inexpensive surplus terminals also are widely available. If I decide to build this system for myself, I'll probably look for a good used Heath H-19, as it already has a front-panel knockout for two half-height drives. The similar Radio Shack DT-1 is another good bet.

Remember, though, that the terminal you choose will have some effect on what software will work with the computer. Public-domain programs that are written for a particular keyboard and display, such as a Heath-19 or a Lear Siegler ADM-3A, may need to be modified to work with a nonstandard keyboard and display. I would not recommend a 40-column display for serious word processing or spreadsheets, for example. For RTTY and CW operating, or for routine QSL logging and calculations, a cheap,used home computer and a junk B&W TV set may be perfectly adequate.

Besides the main components already mentioned, you'll need some cables and connectors. The drives need 34- or 35-conductor ribbon cable and standard 5-1/4" disk-drive edge connectors, one more than the number of drives, as the connector on the Little Board is identical. If you are building a two-drive system, you'll need three connectors; for a four-drive system, five; etc. If you wire the connectors yourself, make sure that the signals are on the even-numbered conductors and the odd ones are grounded.

Using shielded ribbon cable and keeping the length as short as possible will help reduce RFI, both in terms of QRM generated by the computer and computer glitches cause by rf from the station transmitter getting into the system. A grounded metal enclosure for the system plus filtering and bypassing on the power cord will help, too.

Check your Ampro manual and the data sheets and schematics for the drives themselves. Normally, a terminating resistor network goes only on the last drive in the chain and is not needed on the others. You'll also need a power cable and connectors for the board and drives and provisions for bringing the power-on light and reset button line out from the board connector to a convenient location.

The WD-1770 disk-controller chip can handle up to four soft-sector drives in various combinations of single- or double-sided and 48 or 96 tracks per inch (tpi)—40- or 80-track. The CP/M boot disk provided by Ampro is single-sided, 40-track, however, so you'll need at least one of these drives to get your system up and running. Also, in order to use DISKCOPY (one of the disk-copying utilities provided with the Little Board operating system software), you will need at least two drives of the same kind.

The (Original) Ampro Little Board at a Glance

Board Dimensions	7-3/4" x 5-3/4" x 3/4"
CPU	Z-80A at 4 MHz
RAM	64K (eight 64K DRAM chips)
ROM	One 8-bit (2732) EPROM for initialization
I/O	Two RS-232 serial ports, one 75-9600 baud, one 75-38,400 baud, plus one Centronics parallel printer port. One serial port is used to communicate with any RS-232 serial terminal as console.
Disk I/O	Western Digital WD-1770 disk-controller chip can drive one to four 5-1/4" soft-sector disk drives, in any combination of 48 tracks per inch (tpi) and 96 tpi, single- or double-sided drives. Step rates are selectable.
Power Consumption	+5 V dc @ 750 mA, +12 V dc @ 50 mA (The −12 V dc for the RS-232 serial ports is generated on-board.)
Operating System	CP/M 2.2, plus extra utilities and ZCPR enhancements
Price	$249 list (model 1B-1, qty. 1–4, as of April, 1986)
Manufacturer	Ampro Computers, Inc. 67 E. Evelyn Ave. Mountain View CA 94041 (415)-962-0230

(Note: Since KB2JN and I began this project, Ampro has begun phasing out the Original Little Board in favor of a newer version, the Little Board Plus, which includes an added SCSI interface on the same size circuit board. They also now sell a line of piggyback SCSI I/O and STD bus boards which will work with other Z-80 computers as well as the original Little Board. Interested amateurs should inquire about prices, etc., as they probably will have changed by the time this review sees print.)

Documentation

The manual provided with the Little Board has 135 8-1/2" x 11" pages. About a third of this is assembly and operating instructions for the user, and the rest is reprints of data sheets for the key ICs, such as the Z-80A CPU and the Western Digital WD-1770. This seemed a bit on the skimpy side at first to an old Heath/Zenith user, but if you consider the fact that the Little Board not only comes assembled and tested except for cables and peripherals but is also inherently much simpler than older generation Z-80 machines, the manual is more than adequate for the everyday routine user.

Ampro does provide an optional Technical Support Package for customers who are going to use the Little Board in custom or OEM applications. I prefer a large schematic with everything mapped out on one sheet, but the modular schematics provided with the Little Board are clear and easy to read, adequate for most routine troubleshooting.

Software

As for software, the Little Board comes with two complete operating system CCPs, both regular Digital Research CP/M v. 2.2, and ZCPR3 (an enhanced operating system that is compatible with regular CP/M but includes more sophisticated capabilities). You could write a book-length review just on ZCPR; many user groups have several disks filled with help files and special utilities. The most obvious advantages for the beginner are the way file directories and user numbers can be manipulated. ZCPR will allow you to make a file of any disk's directory without retyping, and will shuffle files from disk to disk and user area to user area very easily—something that is difficult or impossible to do from stock CP/M.

ZCPR will also create an optimal path search for a file that's not on the currently logged disk, and the DIR.COM version of the directory utility provided by Ampro allows an almost mind-boggling array of possible arguments and parameters in addition to the stock CP/M DIR A: or DIR B:. You can hide secret files in different user areas and still access and execute them from the currently logged user area and disk—once you know how. This might be important for classroom use, where different students may have to share disk files in different user areas. For myself, being able to PIP together a comprehensive disk library directory without hours of retyping is the most valuable feature.

Besides the usual CP/M utilities like PIP, ED, STAT, and so on, Ampro provides other utilities. AMPRODISK allows you to format, copy, and verify a disk. This is similar to the combined utilities of FORMAT and DUP from Heath and some other manufacturers. MULTIDISK.COM allows you to read and write to other soft-sector CP/M (and CP/M-86) disk formats. It will not allow reading and writing of Heath/Zenith hard-sector or Apple 35-track formats, though. UNERASE.COM allows you to recover an accidentally erased disk file, providing that the disk hasn't been physically over-written or reformatted. STARTUP.COM allows automatic execution of programs upon

power-up or reset. MULTIFMT.COM allows you to format a blank disk in other soft-sector formats, including CP/M-86 formats for some 16-bit computers. SWAPCOPY.COM allows you to copy files from one disk to another using a single drive. DISK7.COM is a sort of enhanced combination of STAT and PIP for manipulating files.

The Multidisk and Multiformat programs are very impressive and support a wide assortment of disk formats, including relatively obscure ones such as Heath Lifeboat and TRS-80 Montezuma CP/M. To use the programs, one of the regular drives is reconfigured as disk E: (for Emulate) and the parameters are selected from a menu.

Conclusions

The Ampro Little Board is a very good little, single-board computer. Besides the small size and low power consumption already mentioned, there are several other positive features. The Z-80A runs at 4 MHz, twice as fast as many early CP/M machines. The memory-management and refresh circuitry is entirely digital, and does not have discrete RC networks, one-shots, and other parts cluttering up the path. This, combined with the physically small size and low chip count, makes for very reliable operation.

One of the two RS-232 serial ports provided will run as fast as 32,400 baud. If your terminal can handle it when serving as a console, running at 19,200 or 32,400 baud instead of the older standard of 9600 baud will result in an amazing speedup in writing to the screen, especially important with I/O-intensive programs like games with graphics. Actual graphics capability will be limited, of course, by your terminal and the CP/M software you are running.

The price has fallen to true bargain levels; Ampro factory ads in ham magazines dated January, 1986, give a list price of $249 in single-unit quantities, and some dealers may even discount this. This is $50 cheaper than just a soft-sector controller card for Heath H-89!

On the negative side, the most serious limitation on the original Little Board is the fact that you have only two RS-232 serial ports and one Centronics parallel printer port. With one serial port tied up talking to your terminal as a console, that leaves just one, putting you in the same boat as stock Kaypro II users. If you want to use both a modem (or RTTY TU) and a serial printer, for example, you have to kluge up a switching or transfer box, or else use an extra-cost parallel-to-serial adapter on the Centronics port to drive the printer.

Also, the serial ports support data only on pins 2 and 3, and handshaking on pins 5 and 20 (CTS and DTR). If you have a fancy modem that uses other lines for handshaking, carrier detect, etc., there may be some problems getting it working, especially for the relatively inexperienced beginner. Unlike some other computers, there is no physical difference between a DCE and a DTE port, which can also be confusing for a beginner. The manual does explain how to get a modem working by inverting pins 2 and 3 plus 5 and 20, though.

Unlike the older Z-80 computers such as the H-8, H-89, and many S-100 systems, there is no bus expansion connector on the original Little Board. This makes adding extra I/O ports and other hardware options fairly difficult. About the only practical approach is for boards that plug piggyback directly into the Z-80 socket. There is at least one manufacturer of clock/calendar boards that work this way and that are relatively inexpensive. Ampro does sell an SCSI expansion card as a $99 extra-cost option to allow additional I/O to be added, and the company has announced a new version of the Little Board, the Little Board Plus™, which includes the SCSI port on the card for about $40 more. This looks like a worthwhile option for more ambitious users and is cheaper than buying the Little Board and SCSI card separately, or even the $59 SCSI upgrade kit. Ampro also sells hard-disk packages, an STD bus adapter, and other options.

In closing, then, the Ampro Little Board is an inexpensive, reliable, and physically small CP/M computer. For applications like custom briefcase computers or low-cost systems for a student or amateur on a budget, it's a good buy indeed. Reader Service number 151.■

Hamcom Terminal Software

by E. Benson Scott AE5V

Advanced Electronic Applications, Inc.
PO Box C-2160
Lynnwood WA 98036
Hamcom—$49.95

With the advent of digital communications and the increasing use of computers in the shack, one is always looking for easier and more efficient ways to combine functions. AEA (Advanced Electronic Applications) markets a program written and supported by Emile Alline NE5S. The program, Hamcom, produces a complete Morse, Baudot, ASCII, and packet communications program for the IBM PC or compatibles. The software has been revised several times; I'll review 4.E, the most recent version. No more will you have to have separate programs for RTTY and packet communications; Hamcom has combined the best of both worlds into one very usable terminal program.

The software is written in Basic, with files on one double-sided, double-density disk. The programs have been compiled to facilitate use and speed enhancement. Other than a brief instruction sheet for setting up the interface connections and a two-page review of the program, all documentation and instructions are included on the disk and can be read from the screen or printed. When printed, the material is 5-1/2 full pages of information including a very nice summary of the control functions.

The setup and default menu is easily and quickly configured. No special knowledge of the computer is required. Line widths from 30 to 80 characters can be programmed. Ten pre-program messages in each code (ASCII, Baudot, CW, and packet) can be written at this time or at any later date. One nice feature is available for those individuals with early IBM equipment with single-sided format: The program is set up so that owners can use single-sided disks in drives A: and B: and not have to purchase double-sided, double-density disk drives.

An IBM PC compatible computer or PCjr with a minimum of 80K of RAM is required. One serial port is necessary to receive the information from the packet TNC or RTTY/CW demodulator.

Codes

The program is menu driven: ASCII, Baudot, CW, packet, setup, and CW practice are options that can be selected. After one decides which code format to use, the next set of options—setting up speed and other parameters—immediately appears. For the advanced user, more unusual formats can be transmitted and received, but for the neophyte, there is nothing to know except which code and speed are desired.

The ASCII section of the program normally operates at 110 or 300 baud, but is variable enough to allow essentially any combination of baud, bits, or parity allowed by DOS.

The Baudot section allows transmission and reception at 60, 66, 75, and 100 wpm. These options should allow for reception of all but the most unusual protocols.

The CW section allows transmission and reception at any speed from five to approximately 100 wpm and is primarily limited by the demodulator interfacing with the radio and computer.

The packet radio section allows one to transmit and receive packet radio using a terminal node controller (TNC). Variable communication rates are allowed between the computer and the TNC.

A very useful portion of the software includes CW practice. Characters may be sent at a fixed rate or as you enter them into the keyboard. For those learning or practicing the art of CW, character speeds are not dependent on word speeds, and variable spacing is quite easy to incorporate into the setup. The speed will slowly but automatically increase if you desire.

Features

Each of the code formats uses a split-

screen technique, allowing transmit and receive buffers to remain independent. Should you have a color monitor, color options are available. Splitting the screen is a status line, which can be moved up or down. This line includes the format, speed, transmit or receive status, local time and date, as well as the disk-saving status, printer status, diddle, and WRU status.

Pre-programmed disk-saved messages up to 256 characters are allowed in each of the code sections of the program, making a total of 40 available. This is a nice feature in that the RTTY station can be listed in the RTTY section of the program and will not interfere with the description of the packet station in the packet portion of the program.

A more unique and fun feature is the ability to capture and save text in either the transmit or receive mode "on the fly" using function keys. Tapping the function key the first time begins the capture; tapping it a second time ends the capture. This material can then be saved or entered into text at a later time with a two-keystroke entry. The transmit and receive buffers are not limited by the program, only by your hardware capacity.

Interfacing with a TNC or RTTY/CW demodulator is quite straightforward. For using most of the newer demodulators or TNCs, all one has to do is plug one end of the RS-232 cable into the computer and the other into the demodulator or TNC. For those with other connection options, instructions come with the program for connecting the push-to-talk (PTT) line, CW transmit-receive lines, ASCII/Baudot transmit-receive lines, and ground.

Conclusions

Packet radio is the most rapidly growing fragment of our hobby. With Hamcom, a terminal program is set up to work with a TNC, alleviating a number of problems associated with some computer terminal programs (such as not allowing control characters other than the standard letters, numbers, and spaces to be transmitted). The packet portion of the program is also different in that it allows you to transmit and receive essentially simultaneously. Transmitted lines are shown in reverse video.

For the beginner, a very useful feature is the ability to use the Hamcom program without it being attached to a demodulator or TNC. In this way, one can become quite adept at using the available functions without confusing all those listening on the air.

Having used several other RTTY programs for other computers and dedicated terminals, I found this software package easy to use and thoroughly thought out. There are very few RTTY/ASCII programs available for the IBM PC. Because the PC is one of the least frequently used computers in the hamshack, software is not as readily available as for some of the smaller computers, such as the Commodore. If one is looking for a computer terminal program to function with a variety of interfaces and provide flexibility, AEA's program might very well fit the bill at a reasonable cost. Reader Service number 152.■

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Brandon FL 33511

A Packet Primer

First you've got to know the lingo.

Packet radio is now very popular, and dozens of amateurs purchase new equipment weekly to get on the air using this new mode. This article will discuss why this new mode is so popular and evaluate the advantages of using packet in comparison with other digital modes.

Join the Packet Radio Revolution!

You may recall that the introduction of machinery into manufacturing during the 18th century greatly changed the way of life in England and other countries. That major change, called the industrial revolution, substituted the power and speed of machinery for the power of man's own muscle and that of animals. That revolution has shaped our way of life today more than anything else.

Today there is a revolution going on in the technical world that ranks in importance with the industrial revolution. Many persons are calling it the information revolution—and packet radio is a part of it. This revolution is based on bringing the power of computers to the process of handling information. It has already changed our way of living and will continue to do so in the future. Its theme is well expressed in an advertising phrase used by a large corporation: Men should think, machines should work. The advent of computerized data processing allows people to emphasize their creative skills and leave the sorting, filing, retrieving, and moving of information to the machines.

The information revolution is primarily sparked by the science of microelectronics, which produces integrated circuits. The lure of something for nothing is very appealing. Haven't you ever wished that you had a printing press to run off a few greenbacks? Well, that's almost the way it is with integrated circuits. Greatly simplified, the process is a form of printing. Much time goes into designing the circuits and photo masks and setting up the equipment, but when everything is completed, the production line turns out thousands of circuits for pennies each. In fact, for many medium-scale integrated circuits, the cost of the package is greater than the cost of the silicon chip inside.

The above trivia is at the heart of the information revolution and the explosion of microcomputers. The spread of microprocessors has been dramatic, covering far more than just microcomputers. I know there is a microprocessor in my microwave oven, my clothes washer (I took it apart), and my automobile ignition, air conditioner, and cruise control. No telling what other device has one in it. The same is true of the ham shack. My handie-talkie, mobile FM rig, HF transceiver, and VHF multimode rigs all are microprocessor controlled. They do the work (when I can remember the proper commands) and I have the fun.

What About Packet Radio?

I believe packet radio is the branch of the information revolution that extends into amateur radio. The power of the microprocessor enables us to have new and more reliable forms of communication. Over the next few years we will see tremendous improvement in the way we are able to pass along information. Packet will not replace CW or phone modes because they are practiced for the enjoyment they bring, but we will see a powerful amateur digital network created that will transform the way we communicate.

At its most basic level, packet is simply another way for amateurs to pass information between them, and in that respect it is no different from the spark-gap transmissions used by the early practitioners of our hobby. With microprocessors in our bag of tricks now, we can move more information in more interesting ways. Each new mode in amateur radio over the years has added to the quality or quantity of information exchanged.

Let me give you an example you must have experienced yourself: Someone visiting your neighbor meets you on the street and comments on your antenna farm. He mentions that he knows a ham just down the street back home and wonders if you could call him to see how things are going. You wonder how to explain the difficulty of contacting that ham—you don't know his callsign, his equipment, his operating habits, etc. It would be a multi-million-to-one shot to turn on your rig and contact him, even if you knew his callsign. So you make some excuse and suggest that he use the telephone.

Now look at how that scene might play when we have an amateur digital network.

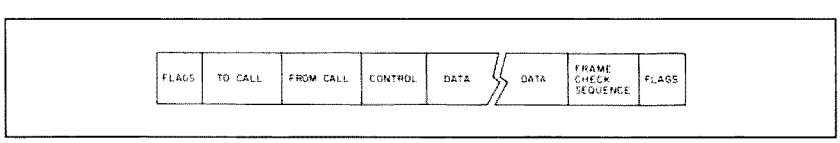


Fig. 1. Schematic representation of a frame.

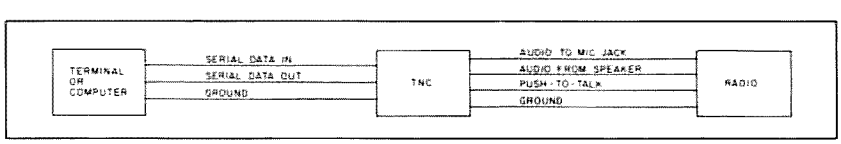


Fig. 2. The minimum equipment required to get on packet.

You obtain some portion of the back-home ham's identification: perhaps his last name and city or his street and city. Then you use your packet terminal to access the network information server. You provide it with the information you have obtained and in turn receive a listing of possible names, callsigns, and addresses, plus any needed routing information. Your visitor can then identify the amateur, and you can send a message using the network. If the other ham is currently on the air, the message is delivered right away. If his station is not operating, the message is stored for him and you are informed of the situation. It's rather like making a phone call, but it is all done via amateur radio. Using the same techniques, you could also have sent him a text file, a computer program, or a video display or picture, or even operated his equipment remotely. Very convenient!

One of the words we hear all the time is "digital." In the strictest sense, hams have been doing digital communication for many decades—they call it CW. Radioteletype (RTTY) and more recently amateur teletype over radio (AMTOR) have become popular forms of digital communication. Packet is also digital, but it has increased capabilities compared with other digital modes because of the advanced techniques used to address and transmit the information.

What Does Packet Do That Other Digital Modes Do Not?

Packet offers several distinct advantages over older digital modes:

1. Robust error detection. It's 1,000 times more comprehensive than AMTOR.

2. Networking. The packet addressing technique allows a series of stations to repeat packets to each other, thus forming a network.

3. Compatibility with computers. Packet supports the transfer of binary data (computer programs) and is the only error-detecting mode supporting the full ASCII encoding used on most computers found in the ham shack.

4. Compatibility with other modes. Packet may be used to transfer any type of information that is in digital form. Thus with proper encoding, the advantages of error detection and networking may be applied to voice and video signals.

5. Speed. HF packet operates at 300 baud, which is some five times faster than RTTY or AMTOR. On VHF, the FCC allows higher speeds, and 1200 baud is commonly used. That is 10 to 20 times faster than RTTY. In the future, data rates of 9600 baud, 56,000 baud, and higher will be used.

Protocols

A protocol can be viewed as a set of exact rules that describe the actions one takes in response to the actions of others, or the actions one should take to elicit a certain response from others. In human interaction, protocols are usually referred to as "etiquette." Most protocol specifications are lengthy, because to be useful they must cover every action and event that is likely to occur.

CW uses a single tone, and the information is transmitted by turning the tone on and off according to an agreed-upon code (Morse). There is a simple protocol for CW

WHAT'S IN A TNC?

The initials TNC (pronounced tee-en-see, and only rarely "Tink") have become synonymous with packet radio in the amateur service. It's the wrong name, but it's too late now. An early amateur digital experimenter designed a device called a Terminal Node Controller as part of a two-part system that included a Station Node Controller. Other experimenters used the TNC as a separate unit in experiments of their own, keeping the same name. The original TNC/SNC project has since faded into the mists of time, and what we now call a TNC is actually a Packet Assembler Disassembler (PAD). A PAD connects a device (such as a terminal or computer) that does not "speak" the network protocol to the network. It collects characters one at a time, assembles them into packets, and sends them out into the network. It also takes packets from the network, disassembles them into individual characters, and sends them to the terminal or computer. If you substitute TNC for PAD when reading non-amateur packet literature, you won't be far wrong.

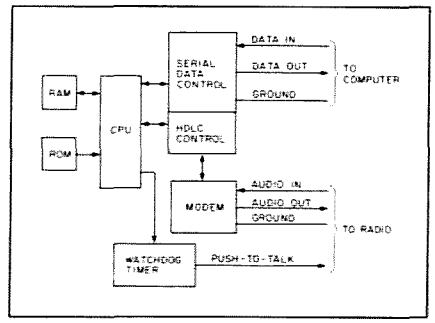


Fig. 3. The major elements of a TNC.

If you open up a TNC, you'll find a general-purpose computer hiding under the hood, chained to a communications chip and modem. As shown in Fig. 3, a TNC is a fairly standard microcomputer, with RAM for storage, ROM for the program, a CPU to make it run, and a serial chip to talk to your terminal or computer. Most TNCs also have an HDLC chip, sometimes as a part of the serial chip. HDLC (High Level Data Link Control) is one of many names used to describe the format of the data sent out over the radio. TNCs with a hardware HDLC chip will be able to run at higher data speeds than TNCs with a "software HDLC." As a practical matter, this is only important if you want to use your TNC with the new satellites coming up (see the article about digital satellites in this issue), or if you want to use the higher speed modems that are beginning to be available. Today, at least, the cost of the units with and without hardware HDLC is about the same.

Another element of a TNC is the modem. The first TNCs did not have modems included as an integral part; the modems were "outboard." In the early days, hams standardized on the Bell 202 modem tones. They did this in following two of the most time-honored of amateur traditions, easy and cheap. Easy—the Bell 202 tones of 1200 Hz and 2200 Hz, designed to fit nicely in a standard telephone bandwidth, also fit nicely into the microphone jack of an amateur 2-meter FM transmitter. No modifications to the radio were required. Cheap—surplus 202 modems were available for less than $100. In the early home-brew days of packet, Bell 202 was the standard, for TNC-based experimentation at least.

When the everything-included TNC kits came out, a modem circuit using the 202 standard was included on the TNC board. After all, the only other people out there to talk to were using home-brew TNCs. Later on, most TNC manufacturers realized that 1200 baud would eventually be too slow, and made their TNCs with a connector that bypassed the on-board modem. This allows for higher speeds, as well as for different standards, such as the PSK modems to be used by the new fleet of digital spacecraft.

The final block in Fig. 3 is the watchdog timer. This is a device that monitors the PTT line that keys your transmitter. The watchdog timer makes sure that the radio is not keyed for an excessive amount of time, should some problem occur in the TNC software. This is not only the neighborly thing to do, it makes the FCC happy as well. Section 97.80 of the amateur rules states: "(a) When under automatic control, devices must be installed and procedures must be implemented which will ensure compliance with the rules when the control operator is not present at the control point of the amateur station."

The watchdog timer is one such device—a cheap and easy way to help make sure that a software or other problem in your TNC doesn't cause your station to come on the air and stay on, jamming out the frequency. Most TNCs have this feature, others have it as an option, and some don't have it at all. If you plan to run your station unattended, look into the matter. To somewhat confuse things, there are two types of watchdog timers. The one included on some TNCs is a PTT timer, but you will sometimes hear of watchdog timers used for digipeaters. These are used to jump-start the TNC itself if it crashes for any reason, and are in general required only for remote locations. See WB6RAL's article on mountaintop digipeaters in this issue.

In general, a TNC contains everything needed to put you on packet radio; all you add is the terminal or computer and a radio.

operators based on prosigns such as KN and Q signals.

RTTY uses two tones, and the information is transmitted by switching back and forth between them (frequency shift keying—FSK) according to an agreed-upon code (Baudot). As in CW, RTTY has some operator conventions on how to hold a QSO, but no real protocol is required.

AMTOR enhances the operation of RTTY by adding selective addressing and limited error detection. It uses a special code based on Baudot. A strict set of protocols defines AMTOR, involving such things as the method of selective calling, error detection, acknowledgment of good data, and timing of transmit and receive cycles. If there is any deviation from those protocols, you're not doing AMTOR any longer.

Packet basically uses the ASCII code for character representation, although binary data (object code) and digitized voice, video, and telemetry may be transmitted equally well. Packet currently uses FSK just as RTTY does, but that modulation technique is not required. Future equipment will use modulation techniques adapted for higher data rates. Protocols are the major source of packet's power and usefulness, and are mainly a matter of software. The protocols used by packet are far more complex than any protocol used in amateur radio to date. This is in part necessary because a computer is inherently less "intelligent" than a human—less so than even the most reprobate kerchunker. A computer has no common sense whatsoever. The kerchunker's sense is debatable.

Protocol History

The microprocessor revolution has made possible low-cost equipment that will automatically follow complicated protocols for the operator. Packet protocols (and hardware) have been adapted from commercial computer terminal networks. In a large office building with 400 to 1,000 terminals operating from a mainframe computer, you don't want to run a separate piece of coax to each terminal. In that situation, all the terminals are probably daisy-chained on one run of cable. When the host computer desires to transmit to a particular terminal, it places the identification of the intended terminal in the header of the message. All terminals listen to all messages and only the one seeing its own identification will respond to the message.

Packet radio uses this same technique, except an rf channel is substituted for the cable. The formats used in addressing the messages, the timing factors in sharing a channel, and numerous other items make up protocols. Various layers of protocol deal with different portions of the information transfer. Lower-layer protocols deal with the type of signal voltages and connections, the modulation techniques and data encoding, etc. Higher-layer protocols deal with addressing messages through the network, converting data formats among differing computers and terminals, handling file transfers and remote

BETTER HOMES AND SHACKS—SOME TNC-EQUIPPED STATIONS

Packet radio stations come in all shapes and sizes. Photo A shows a small portable configuration. This is the traveling road-show station used by NK6K at packet demonstrations. There are several portable computers and TNCs that will fit the same footprint. The radio is a 2-meter HT; the 6-volt cells power the TNC. The smallest, lowest power TNC is the GLB PK1-L (not pictured). GLB's ads say the size is 4.5" x 5.9" x 1.0" and it draws about 25 mA typical power. I've seen one running at a show on a 9-volt battery. Packet stations similar to the one shown here have been on boats and planes and in other interesting places. A station very similar to the one pictured here using a Radio Shack TRS-80 Model 100, a specially built TNC-2, a specially modified Motorola radio, and a special container is ready to be qualified to fly on the next Shuttle Amateur Radio Experiment (SAREX) flight.

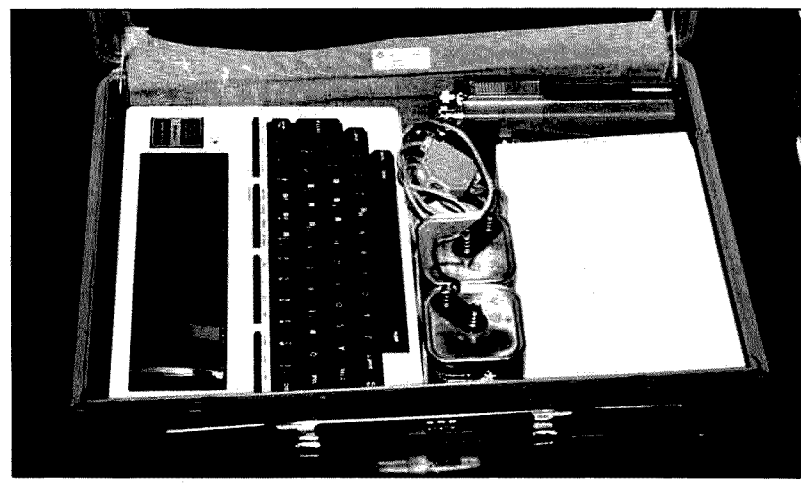


Photo A.

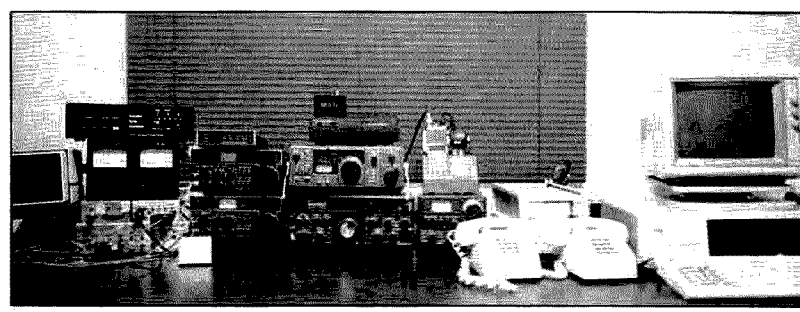


Photo B.

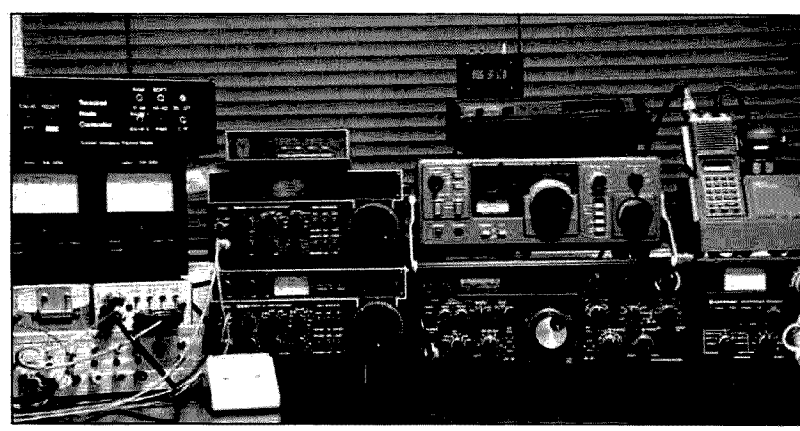


Photo C.

Photo B shows a fully equipped packet station, ready for action on HF, VHF, UHF, OSCAR-10, and UoSAT-OSCAR-11. It is also running a bulletin board system on the IBM-PC. The closeup in Photo C shows (top to bottom, left to right): TAPR TNC-1, azimuth and elevation rotor control for the satellite antennas, Uo-11 command encoder and decoder, power supply, TAPR TNC-2, IC-251 two-meter radio for local packet and satellite downlink, IC-451 430–440-MHz radio for satellite uplink, polarization switches for the satellite antennas, UTC clock (the photo was taken very late at night), Bearcat scanner to receive packets in the commercial bands*, R-1000 general-coverage receiver, TS-830 for HF packet, 440–450 transceiver for local chit-chat, and HF antenna tuner. Packet can be used to enhance your station in whatever activity you're engaged in. Unattended CW DX spotters nets anyone? How about a worldwide EME schedule data base?

Photo D shows Skip Hansen WB6YMH's very neat arrangement for an automated BBS station. The entire station is mounted in a 19″ rack cabinet. From top to bottom are: thin white box housing a TAPR TNC-1, a shelf containing a TNC-2, a phone and dial-up modem, a vintage IMSAI 8080 computer, a UHF and a VHF radio, four 8″ disk drives, the CRT for a Xerox 820 computer, and another white box containing a Xerox 820. This rack actually contains two BBS systems, one on packet and one attached to the phone lines. There is no connection between the two systems, which is the best way to avoid third-party problems. The Xerox 820 runs a standard CP/M system; WB6YMH-2 is a host, file-server, and a mailbox system.



Photo D.

Photo E shows a very simple system consisting of a two-meter radio (with amplifier), an Apple-II computer, and a TNC-1 mounted in the black box under the CRT. The photo is actually deceptively simple, since this station is also the busiest BBS in the Los Angeles basin. A station need not be sprawling to get a job done. This station is N6BGW-9, run by Scott Avent.

*I'd like to point out that amateur TNCs which were designed by hams in garages are in use in the commercial services. TNCs are in use in a variety of places around the world doing various jobs. This is the best example in recent years of amateurs living up to Part 97.1(c) of the FCC rules: "Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art." Why are amateur-designed TNCs showing up in the real world? They're cheap and easy to use, of course. Amateur doesn't mean unprofessional.

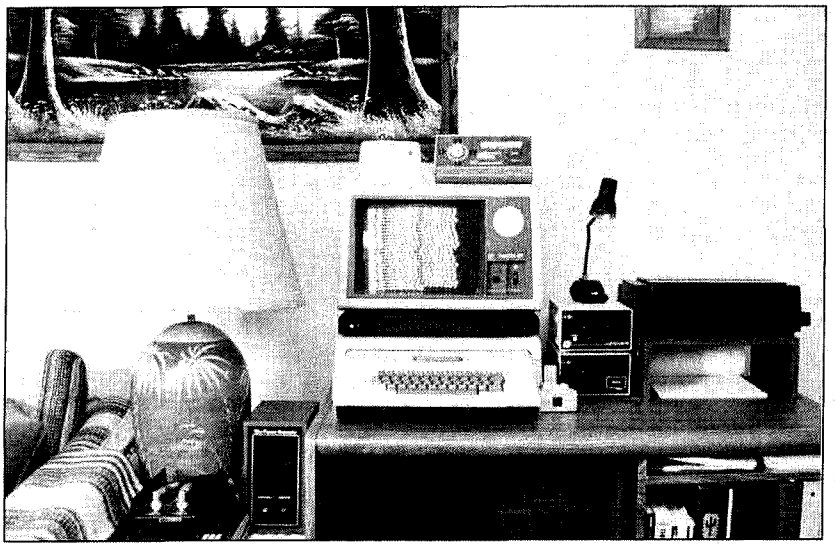


Photo E.

data-base accesses, etc. At the highest layer, protocols deal directly with the user or his program and perform work for the user without making him aware of the part the network is playing.

AX.25 Protocol

Much of the progress to date in packet radio is due to the adoption of a standard link-layer protocol that makes packet equipment from all manufacturers fully compatible. This protocol is AX.25, the amateur version of the international X.25 protocol. Other protocols were used originally, and some areas have not converted to the AX.25 standard, but layer 2 protocol is no longer an open issue. Development and experimentation with layer 3 and 4 protocols is going on, but no standardization is likely in the near future. Much experimentation will be done to determine which method(s) will work best in the amateur-radio environment.

What Does a Packet Look Like?

A more appropriate heading here probably would be "What does a frame look like?" A TNC transmits frames, which include flags, addresses, commands, information, and error-checking information. The user's information is properly called a packet of data. Popular usage, however, calls the whole frame a packet. The frame begins with a flag consisting of a special series of ones and zeros. (Remember, at the digital level, everything is either a one or a zero.) Next come the callsigns of the sending station, the station intended to receive the frame, and all those stations that are to repeat the frame on the way to its destination. Then a field identifies the type of frame being sent—connection request, acknowledgment, or status polling, for example. If the frame is supposed to contain data, the control field is followed by a packet of data.

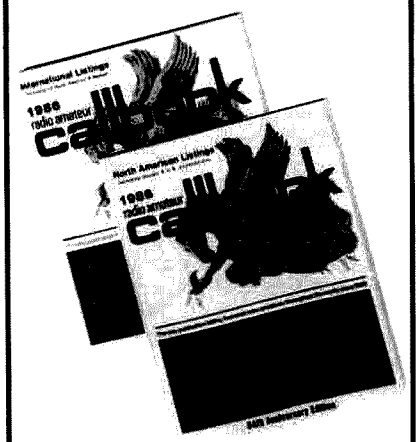
Next comes an error-checking field, which works like this: The entire frame (including addresses, etc.) is made an input to a mathematical formula (think of it as long division). The remainder from that operation is included in the frame in the Frame Check Sequence field. When the frame arrives, the same mathematical formula is applied. If the remainders are equal, then the frame is presumed to be error-free. If the new remainder is not the same, no attempt is made to correct the data. Instead, the frame is thrown away and retransmitted.

Fig. 1 shows a schematic representation of a frame. Remember, a microprocessor takes care of all of this for you, and at the end of the process presents you with the data contained in each frame.

Networking

Protocols make networking possible. The techniques described above for the computer terminals are even more valuable in the amateur environment. While a RTTY or AMTOR station can talk directly to only one other station, packet stations can extend their range by using other packet stations as repeaters. These digital repeaters are not the

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same as the FM voice repeaters we are used to. In fact, any packet station can be a digipeater. Remember that each packet station listens to every transmission on the frequency to see if that transmission is addressed to it. It also looks at each transmission to see if it is supposed to be repeated. The addressing information specifies which stations are to repeat the information and in what order they are to repeat it. Thus a chain of repeater stations may pass along a message and carry it a long distance beyond the local area. That is the basis of networking.

Packet Is Fun

Enough of the theory and history! Packet is loads of fun. Thousands of hams use packet for rag-chewing just as they do any other mode. You can share the channel with a dozen other conversations and watch them all at once if you like. Or you can limit your screen to displaying only what is sent by the person with whom you are conversing.

A major pastime on packet is non-real-time communication. Real-time communication is when both parties in the conversation are on the air at the same time. In amateur radio, the further apart two real-time stations are, the greater the chance that one of the parties is either up late, up early, skipping work, or retired. In non-real-time communication, only one party needs to be on the air at a time. The originator of a message leaves the message on a "mailbox," which stores it for later retrieval. This is similar to leaving a written message taped to the refrigerator door for a family member who won't be home when you are. As long as the mailbox is accessible 24 hours a day, communication can occur between two persons regardless of whether they are both on the air at the same time or not. This frees the amateur from the tyranny of the clock—and the ionosphere.

There are numerous mailboxes or bulletin-board stations active on packet. ARRL bulletins, newsletters, computer files and programs, and many public and personal messages are available on these computer systems for access by anyone within packet range (and remember that packet range is greatly extended by the use of digipeaters). The network automatically forwards messages to the mailbox serving the addressee. It is very thrilling (and convenient) to check into your local mailbox and get messages from numerous states and several countries.

What does it take to get on packet radio? The minimum equipment is a terminal node controller (TNC), which is the packet controller; a 2-meter FM radio and antenna; and either a computer or a terminal (see Fig. 2).

The TNC is the device that contains the microprocessor that does most of the work of getting your information sent and received. There are now a variety of TNCs to choose from, in a variety of price ranges and capabilities. There will no doubt be ads for several TNCs in this issue of *73*. Many radio stores have TNCs on display, and most clubs have at least one person on the air with packet. Although it takes many words to describe what packet is, it only takes a few minutes to see what it can do when you get a demonstration.

Packet can be used with any radio capable of sending voice—i.e., those with microphone jacks—and can be sent anywhere the F1 emission is permitted. In practice, taking various gentlemen's agreements into account, packet is in the "RTTY" portion of the HF bands, all but the "CW only" portions of the 6- and 2-meter bands, and everywhere else. Avoid repeaters where digital is not welcome and, of course, don't interrupt a conversation in progress on simplex channels. The most common radio used for packet today is the 2-meter FM rig.

The terminal is any device that has a keyboard for inputting information and commands to the packet controller, and a screen or printer for displaying the information that comes in from the controller. If you use a computer as a terminal, it needs to have communication software to make it act like a terminal. Any software that works with a telephone modem will work fine with a packet controller. In general, any stand-alone terminal will work, as will any computer equipped to handle an external mode. The key words to look for are "serial," "RS-232," and "ASCII."

The Future

As more and more packet stations come on the air, there is increased support for a good network. Since the radio and computer gear to form such a network is not inexpensive, clubs are forming to take on the job of supplying such equipment. Many traditional clubs are showing more packet awareness and will be willing to support a packet repeater or network node, just as they have supported an FM voice repeater in the past.

Satellites will play an exciting and important role in the packet network. OSCAR 10 is used for packet connections, and OSCAR 11 carries the Digital Communications Experiment. Future satellites will provide even more packet services. JAS-1 should be up about the time you read this and will provide a space-borne store-and-forward mailbox capability.

Within a few years, the nationwide network described above will be in place. Certain amateurs or clubs will operate high-capacity micro- or minicomputers on the network to provide on-line access to information of interest to amateurs. This includes things such as special interest groups for various types of amateur activity, indexes to magazine articles, propagation forecasts, and technical data and specifications. It is really going to be convenient, useful, and lots of fun. Please read the additional articles in this series for more information on packet satellites, mailboxes, operating practices, and other interesting information. Join a local or national packet club, get some packet equipment, and "meet me on the keys."■

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How To Make Friends At 1200 Baud

W2JUP's guide to AX.25 etiquette.

The first time you hear the stuff, your reaction might be: Your squelch control is open, you've got intermod on 145.01, the Army Reserve has fired up the local military radar site, or even a lovesick wasp with asthma is trapped inside your HT.

So you reset the squelch control, verify that the radar site is not up, and spray the inside of your HT with bug killer. But after you've heard the noise for the nth time, you begin to notice a slightly musical tone to it—once you've realized it's some kind of radio signal. But it's unlike anything you've ever heard on ham radio. You're listening to what many professionals see as the future of data communication, and what some amateurs call the future of ham radio. You're hearing packet radio.

Now that you know that it's packet radio, your reactions may fall into various categories:

- The Archie Bunker types: "Aw jeez, Edith, them theah digital joiks is spreadin' all over and lousin' up all our verce channels."
- The computer-enthusiast types with the lower-class tickets: "Hmm. I guess it's time to think about upgrading my ticket."
- The experienced RTTYers: "Ho hum. It'll never last, it's too complicated for hams."
- The "professional" hams: "Hmm! I wonder how much this will cost."

Regardless of the category into which you fall, these bursts of strange sounds flowing through your loudspeakers represent the latest technology brought into the amateur-radio art from established commercial practices. In addition to digital fun cavorting across the ethereal spectrum with buckets full of bits, bytes, and bauds, packet radio brings a new concept of the "network" to amateur-radio operation.

Although hams have operated nets since the beginning of the service, the packet-network idea is very different: Each packet-network user must work in a manner not previously required—by using "shared resources." In spite of their dedication of time and equipment, unless members of a packet-radio community understand the basic capabilities and limitations of the equipment and the mode and give sufficient thought to planning and living together, the packet-radio network cannot survive.

Different Strokes for Different Folks

Although our packet networks are very new, in many major metropolitan areas you can already see several types of packet operation on a single channel: direct keyboard-to-keyboard live QSOs (like conventional RTTY); keyboard-to-keyboard live QSOs via packet repeaters (digipeaters); sending/receiving "mail" messages, files, and programs between live keyboards and PBBSs; automatic mail forwarding between PBBSs—either direct or via one or more digipeaters; and personal packet mailboxes and packet "answering machines."

Is it possible for all these diverse applications to co-exist on a single channel? The answer depends on the behavior of each packet system operator. This article offers a few collected thoughts and suggestions about: bandwidth of transmitted signals, transmitter keying characteristics and time constants, receiver agc time constants, TNC parameter values (especially "timing"), beacons, and channel courtesy and good manners.

Packet Radio—The Shared Resource

Successful packet-radio operation requires a level of cooperation among station operators previously unknown in traditional CW, SSB, and RTTY practices on HF. VHF packet operation must be carefully coordinated and channelized. The "independent" operator cannot survive; no one stands alone in packet radio. Each packet-radio user has a direct effect on the performance of the network and the network's usefulness to the community.

Several regional and local frequency-coordination councils have already begun to coordinate or "assign" selected channels on VHF/UHF bands to "exclusive" packet-radio service. In many areas, packet operations on the two-meter band are channelized on 20-kHz centers between 144.90 and 145.10 MHz.

We can share our limited packet spectrum resources successfully. Our success depends on each packet station operator paying special attention to factors that were not quite so critical in non-packet days. Let's take a look at some of them.

Bandwidth

Bandwidth is the amount of space we occupy in the spectrum, and depends on the modulation index and data rates. This factor includes the "deviation" of the FM/PM signal, the frequencies of the tones modulating the carrier, keying and baud rates, and the nature of the data being transmitted.

In Part 97.65, the FCC defines bandwidth as "the width of the frequency band, outside of which the mean power of any emission is attenuated by at least 26 decibels below the mean power level of the total emission. A 3-kHz sampling bandwidth is used by the FCC in making this determination."

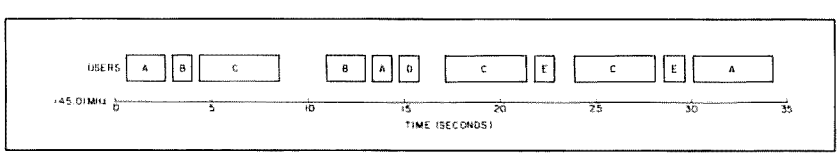


Fig. 1. Packet users share a frequency on a time scale much smaller than any previously experienced in amateur radio. A misadjustment at one station can perturb several others.

Although audio distortion and poor frequency response contribute to increasing the error rate and the packet transmission problem, the bandwidth factor that varies the most and generally does the most damage is deviation—a factor that any operator can easily control. The general rules used in establishing "proper" deviation in voice service are detrimental to your packet's health.

To prevent transmitting an excessively broad FM/PM signal, deviation must be kept *lower* than that normally used in voice service. We must walk a fine line between our deviation being too low, resulting in poor or unacceptable signal-to-noise ratios in weak rf signals at the distant receiver, and deviation being too high for the distant receiver's i-f and demodulation circuits to decode successfully. Either extreme results in high error rates, poor decoding, invalid frames, excessive retries, timeouts, untimely disconnects, and unnecessary reconnection attempts.

Many packet operators use the same radio for packet that they use in voice operation and connect their TNC's AFSK output to the radio's microphone input. In some cases satisfactory results are obtained. When there are problems, they may arise from the way the radio has been set up—microphone amplifier gain and deviation limiting or audio agc action. Most radios coming from Japan (and most of them do these days!) arrive with the deviation set so that the average U.S. ham will enjoy rather high deviation. This characteristic may be due to the fact that in Japan there are few repeaters, simplex operation is the accepted concept, and the radios are set up in factory production test fixtures for some value of deviation obtained with a given value of audio tone input. One theory has it that the input setup values represent the typical soft-spoken local user.

When it's possible, the TNC's AFSK output should be connected to some internal point *after* all speech processing, at the input to the usual varactor modulator. Many radios offer a separate input for tone encoders and DTMF push-button pads. If they're available, that's probably the best point at which to inject the AFSK tones. Any possibility of distorting the AFSK signals by over-driving the microphone input amplifier, diode clipping, or excessive audio agc action can be eliminated.

Carson's Bandwidth Rule defines the approximate bandwidth requirements of communications system components for a carrier signal that is modulated by a continuous or broad spectrum of frequencies rather than a single frequency. In most amateur packet-radio operation, the modulation index (peak deviation divided by the highest modulating tone frequency) will be greater than 1, and the bandwidth is:

$$Bw = 2(Df + 2Fm)$$

Bandwidth equals twice the sum of the peak deviation (Df) and twice the highest modulating frequency (Fm). Table 1 shows these values for the two tones used in VHF/UHF packet radio (Bell 202 tones).

Modern FM receivers have 6-dB i-f bandwidths on the order of 12 to 15 kHz. The better (more selective) the receiver i-f is, the greater the tendency for the receiver to distort highly deviated signals and send distorted audio output to the TNC. The TNC's demodulator may "barf" on the audio, fail to decode the packet frame properly, throw the frame away, and sit there waiting for the retries (the retransmission of a packet whose reception was not acknowledged). Retries are to be avoided, especially when a frame should have been received but wasn't.

During the past several years, I've "fixed" dozens of "I can't connect!" complaints by helping the stricken newcomer to reduce his deviation to a point at which the receiving station's equipment had something better than "square-wave audio" to demodulate.

We must also consider operation on channels 20-kHz wide. If we are to permit nearby packet stations to operate on adjacent channels, it is clear that each adjacent-channel user's peak deviation must be held below 4 kHz to prevent sideband energy from invading the next channel. As a general rule, transmitter peak deviation should be held to a value between 2 and 3.5 kHz. The other guy's receiver will like it, and your neighbor on the next channel will appreciate your courtesy. Don't be a deviant with your deviation!

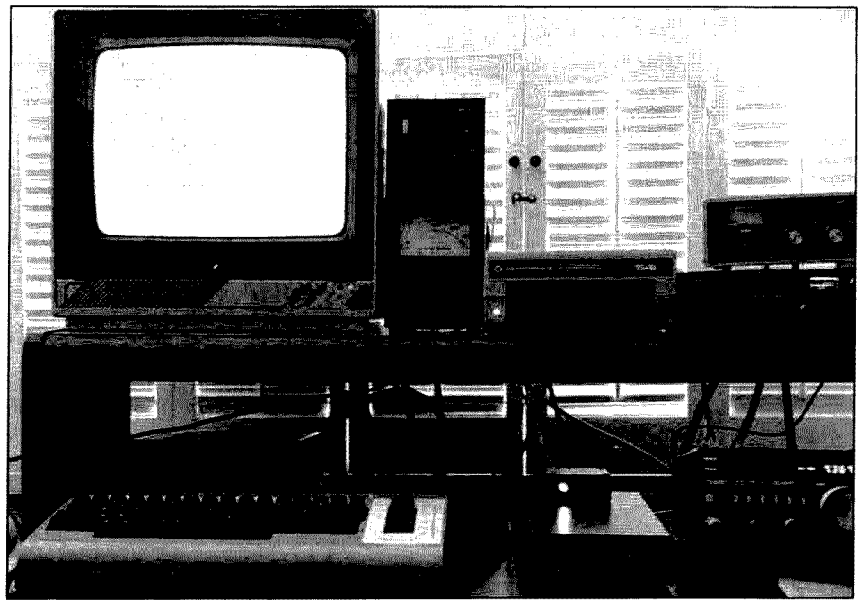


Photo A. One of the more common types of packet stations among new packeteers is the Commodore-64 based system which uses either a stand-alone TNC or a unit specially designed for the C-64—like the one pictured here, AEA's PK-64. This station belongs to Colin Hall, G4JPZ/W6. It features (top to bottom, left to right): CRT, antenna rotor, C-64; antenna switches, antenna rotor; C-64 disk drive, power switch for PK-64 (home-brew), PK-64; HF tuner, VHF radio, HF radio.

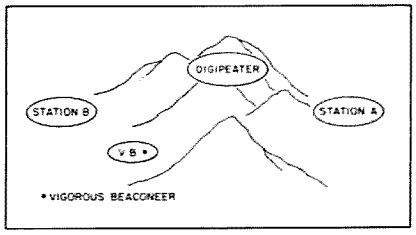


Fig. 2. Station A is shielded by hills and can't hear the vigorous beaconeer. Although station A thinks the frequency is clear, if he transmits while the beaconeer is transmitting, the packets will collide at the digipeater. Packets from station A to station B will have to be retried more often, adding to congestion on the channel.

Software

Many newcomers (and some experienced packeteers as well!) appear to be intimidated by the numerous TNC parameters. Some users seem to be afraid to change any of the values. Well, fear not! Your TNC will not dissolve into a cloud of vaporized chips, nor will your radio leap off the table. There is nothing sacred about most settings. Many values were made variable to permit the user to make changes in accordance with each local circumstance and condition. The specific tuning parameters referred to below reference the TAPR command set used on most TNCs.

A lot of this fear-of-change attitude relates to timing values like FRACK, DWAIT, TXDELAY, and some frame-size and "window" settings like PACLEN and MAXFRAME.

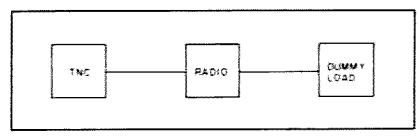


Fig. 3. The proper setup for sending "capture buffer open, digi on" beacons.

Tone Frequency 1200 Hz		Tone Frequency 2200 Hz	
Deviation (kHz)	Bandwidth (kHz)	Deviation (kHz)	Bandwidth (kHz)
1	6.8	1	10.8
2	8.8	2	12.8
3	10.8	3	14.8
4	12.8	4	16.8
5	14.8	5	18.8
6	16.8	6	20.8
7	18.8	7	22.8
8	20.8	8	24.8
9	22.8	9	26.8
10	24.8	10	28.8

Table 1. Bandwidth resulting from modulating an FM signal at various deviations with standard packet-radio tones.

User Type	Time msec	TNC-1 DWAIT	TNC-2 DWAIT
Digipeaters	*	*	*
Keyboard users	160	4	16
BBS/UNIX Nodes, etc.	320	8	32
User file transfer	480	12	48

* DWAIT is ignored for digipeated frames.

Table 2. DWAIT settings for various types of activity.

QRL—I am busy (Don't connect!)
QRR—I am ready for automatic operation (OK connect)
QRU—I have nothing for you
QRV—I am ready
OSO—I can communicate with (callsign)
QSR—Repeat your call on the calling frequency, did not hear you
QSX—I am listening on (frequency)
QTC—I have traffic for (callsign)
QTU—My station is open from (hours-to-hours)
QTV—Listen for me on (frequency)

Table 3. Clever Q-signals that can be used in a beacon text.

Here are some thoughts on the use of the timing parameters available in your TNCs. Perhaps a couple of ideas expressed here might clarify a few implications not fully explained in the vendors' manuals.

FRACK

This value is the number of *seconds* that your TNC will wait for an acknowledgement (ACK) before sending a retry packet. If you have a really good path to the other station and the packets are very solid, you can leave this value at the default setting of 3 seconds. Reducing FRACK doesn't really increase the speed at which packets are transferred. But if the channel is busy and there are many stations on, especially if there's a PBBS (public bulletin-board system) or dedicated digipeater serving multiple users on the channel, you'll probably get better results by increasing FRACK to a higher value of perhaps 6 or even 8. This means that, before your TNC sends a retry, it will wait longer to decide that the other station never got your last packet. This is especially important if the station to which you're connected hears lots of packets from other stations that you may not be hearing.

Remember that these TNCs have CSMA (Carrier Sense Multiple Access): The TNC listens on the channel, and if it hears data—or noise, intermod, or open squelch that it thinks might be data on the channel—your TNC will not key the PTT or transmit data until it hears some kind of silence on the channel, even a bare second. If the other station's TNC is hearing all kinds of stuff besides your signals, and even though it has received your packet nicely, it usually can't send the ACK back to you until it hears a pause in the channel's activity.

The distant TNC may be sitting there having swallowed dandy data, ready to ACK, and meanwhile your TNC (set with too short a FRACK value) thinks that your last packet got trashed and decides to send a second (or third, or...) copy. And so the confusion builds—collisions and eventual timeouts and disconnects are the result.

If you're working into a PBBS (especially through a busy community digipeater), try operating with higher FRACK settings in your TNCs during the busiest hours. These are the times when collisions, noise, and intermod are at their worst levels. Because the PBBS' TNC may be hearing lots of other things when it is listening for you, the CSMA feature in the TNCs may prevent the PBBS from answering you promptly. Therefore, if FRACK is too short for the existing conditions, your system will automatically retry each packet. The net result again is excessive timeouts and disconnects. I suggest strongly that for working the local PBBS during the evening and weekend hours *set FRACK to 8!* That will help the PBBS during its wait for a brief clear spot between bursts of everyone else's packets.

Slow down! What's the rush? Increase FRACK when the channel is busy or when you're working through a station or digipeater in a high-elevation location. Try to understand what the systems are attempting to do.

TXDELAY

This is the length of time (the units vary on different TNCs) that your TNC will wait between the moment when it keys PTT to put your rig on the air, and when the TNC actually unlatches and sends the packet data out to the rig.

During the TXDELAY period, the TNC sends a stream of contiguous FLAG fields (01111110), until it begins the actual frame contents. Some of you may think of TXDELAY only in regard to the time it takes for your transmitter to switch on and develop power. TXDELAY must also be considered in terms of how long it takes for the other station's receiver to unsquelch and recover its full sensitivity after its transmitter shuts off. Some radios take a relatively long time between "transmitter-off" and "receiver-on."

If your TXDELAY setting is too short for the other station's receiver recovery time, that station may not be able to successfully decode the SYNC FLAG (8 bits) at the beginning of your packet frame; its system will not see a valid packet; you'll get no ACK; you retry; the other station still gets no sync; etc. The end result is lots of unnecessary retries, timeouts, disconnects, and frustration.

AXDELAY and AXHANG

If you are *not* going through a voice repeater or a series of non-packet auxiliary and link systems, these values should be left at *zero*. They are basically irrelevant in the straight digital world.

MAXFRAME

This is the number of frames (packets) sent in a single transmission by your station. You can send from one to seven. Although it may seem contradictory, in many cases MAXFRAME=1 can produce the best throughput (amount of information transferred in a given time period or session).

If you're on an empty channel (?) transferring longish files—either text or binary data—with a nearby station over a very solid

path, you can leave MAXFRAME at the default value of 4. If you have a path with a problem or two and are seeing retries due to conditions or collisions, set MAXFRAME to a *lower* value. That way, the distant end has fewer contiguous frames to decode and validate, and the channel has a bit more breathing space through which other stations can slip a packet now and then. If retries become frequent, set MAXFRAME to 1. You and your partner have a better chance of getting the ACKs back. Remember this—if the distant station decodes your packet properly and sends you an ACK, your TNC must also receive the returning ACK! It's a bummer when the other guy's good ACKs are getting trashed on the way back to you!

PACLEN

This is the maximum number of octets or bytes (characters that you type) that can be squeezed into one packet frame. The AX.25 maximum is 256 bytes. The default value is 128 bytes.

Don't get into the lazy habit of typing endless lines of stuff with never a carriage return, depending on your TNC to packetize and send the stuff after the 128th character you type. Even on the C-64's 40-column screen, it's easy to judge when you've typed between a line-and-a-half and two full lines. Type a carriage return after the last word that fits nicely before the end of the second line. That way, you'll be sending packet frames with just under 80 bytes, and the probabilities improve for your successful packet. On a busy channel, the shortest packets get the best results!

In addition to packet length, carriage returns are important in maintaining visual fidelity. Remember that just because your terminal, computer, or TNC has inserted a local carriage return when echoing data to you, it probably has not put in a carriage return for the other user. This usually results in run-on, hard-to-read text at the distant end. Some PBBSs will ignore message text if the line length before a carriage return is more the 80 characters.

On an 80-column screen, 128 characters are a bit more than 1-1/2 lines of typing. On the C-64's screen, that's more than three lines of typing. If the going gets rough judging by the retries over a lousy path, or there are lots of collisions with other stations, *reduce* PACLEN to 64 or even to 32. The shorter the packet frame's length is, the greater the probability of getting a good packet through.

Experience is showing that, on busy channels (especially with PBBSs and digipeaters), increasing FRACK and TXDELAY, while reducing PACLEN, can actually *improve* your throughput rather than degrade it!

Remember—there's nothing sacred about the TXDELAY, FRACK, MAXFRAME, and PACLEN default values. Experiment with other values and see what happens. It can only help—it will never hurt.

DWAIT

This is the length of time that your TNC will wait after last hearing data on the channel before starting the TXDELAY timer to key your transmitter's PTT line, *unless* the TNC is waiting to transmit digipeated packets. DWAIT is particularly important when working with digipeaters on a busy channel. Remember that DWAIT is affected by your TXDELAY setting, and for best results should be set at some value established in agreement with other local packet operators.

DWAIT's main function is to help prevent or reduce collisions with digipeated packets. Dr. Tom Clark W3IWI suggests the TNC timings in Table 2 to improve channel throughput when PBBSs, digipeaters, and keyboard-to-keyboard users share a common channel.

RETRIES

This is the number of times your TNC will repeat the same packet to the distant station if your TNC has not received an ACK. Good practice is to set RETRIES for the lowest number that can be effective in any given condition. The default value of 10 is reasonable for general operation. But if you're trying to force lengthy packets through five digipeaters over marginal paths in busy channel hours, RETRIES=15 (maximum number) will probably do nothing more than antagonize the rest of the troops on the channel.

"I expect to answer my terminal when it beeps—I get cranky when I see that it's merely another nonsense beacon carrying BELL signals."

Note that on some TNCs, RETRIES=0 sets an *infinite* number of retries! In the metro New York, Chicago, Miami, and Los Angeles areas, this is guaranteed to earn you a late-night visit from one of those fellas with the long coats and black leather gloves. Punishing the channel and its population with large quantities of fruitless retries is not the best way to win the local packet popularity contest.

Beacons

If the renowned anthropologist Margaret Mead were still alive, she could study the packet channel population as she did the puberty rituals of the Trobriand Islanders. Upon reaching puberty, each young male anoints himself with bright red mud and parades around the village for a month, thus advising all young unattached females of his new maturity and availability.

Judging by each week's new beacons on our local area channels—you know, the beacons that come on every two to six minutes and give us callsign, name, QTH in painful detail, and "digipeater on, buffer save to disk enabled"—new packeteers seem much like the Trobrianders. This must be a "packet puberty" ritual: "Here I am. Come and use me!"

You can't legislate common sense. Either a person has it or not. Seems some people need that beacon to reinforce their ego and make sure that the packet community at large *knows* that they have packet radio.

What could be more redundant than a beacon like those we see from stations (some of whose callsigns show them to be "old-timers") advising us regularly that they are running a "Packet Radio Communications Facility"? No kidding! It must take Dick Tracy to figure out that a packet beacon emanates from a "Packet Radio Communications Facility"! Now tell us something we *don't* know! Some of these "vigorous beaconeers" have had their callsigns used to test the operation of the LCALLS (ignore packets) routines in the TNC-2 and PK-80!

Most of these ludicrous beacon texts could be stuffed into the CTEXT file, so that the nonsense about "BUFFER OPEN—AUTOSAVE TO DISK ENABLED" would be sent *only* to the station that connects to them. But, unfortunately, that would take a generous dose of common sense and a bit of time to read the equipment manual, add two and two, and not get 22.

It's beginning to remind me of what happened to the older two-meter operators when the two-meter repeater infestation started and the air was filled with nonsense. That certainly spurred the development of 440! I wonder how long it's gonna take the technology-oriented packet people to move up to 220 and 440 and 1296 megs so that the "beacon freaks" can have these channels all to themselves.

It's so easy to find out if your buddy is running his digipeater. All you do is loop back (connect to yourself) through his station. If you get a connection, guess what? His digi is ENABLED! If not, oh well.

Are Beacons Justifiable?

In my opinion, there is very limited justification for beacons on a packet channel. The problems come from the way people use them. Here's what I mean:

Beacons are *not* inherently bad—their intended purpose is misunderstood, and they are frequently misused by newcomers. The beacon can still perform vital functions when properly written and appropriately used. This is especially true as we begin to expand into collateral or additional packet channels on two meters and on the other bands.

Understand the origin of the beacon feature—why it was provided. It really was an important option in the early 1980s when the packet-radio world was a vast wasteland and we needed efficient means of letting the world know that someone was alive, well, and available on the channel and ready for connecting. The beacon also provided an ex-

cellent source of test messages for lining up the early TNCs when there were no other means of testing the kits.

As we all know now, packet radio is *no wasteland*. In many large cities, we already have more users than our primary channel can handle most of the time. For the primary channels in metropolitan areas, the beacon function has outlived its original design intent. Beacons should be re-evaluated and tailored carefully and specifically to present (and future) conditions of channel purpose, assignment, and occupancy.

Apparently some users don't know what a beacon text will look like on the distant station's screen. They put their callsign in their beacon text, not realizing that their callsign will be displayed in the header text on almost all systems—unnecessary, redundant information.

Apparently some users don't know the default conditions of most TNCs. Nearly all of them (and I have tested five types) will boot up with DIGIPEAT enabled and will perform the digipeat function unless you tell them not to. So, why use the beacon text to advise everyone on the channel of something that can be assumed automatically?—more unnecessary information.

Some users feel the need to tell the channel that their "buffer save to disk is enabled." That's something else the rest of the users can assume. With the proliferation of the smarter TNCs like the TNC-2 types and the PAKRATTs, with smart buffers and autoconnect messages, the receiving TNC itself can provide this information *after* the user connects to it—it's not needed as part of the beacon text.

Some users feel compelled to suggest connection paths in the beacon text. Any reasonable TNC with a trace or special header function permits the others on channel to derive the beacon path when and if they need it—more unneeded data.

What is needed in a "meaningful" beacon text? Here are my suggestions: absolute brevity—minimum bytes to get the idea across; name of operator; QTH in City, State format; grid locator in XXNNnn format; special *temporary* information, such as test conditions, new operating hours, power reductions, changes in effect, and directed messages like "W2XXX PLS CALL ME URGENT"; Q-signals cleverly used, as originally intended (see Table 3); international Z-signals (available on request); and a generous dose of common sense.

What is undesirable in a "meaningful" beacon text? Anything unessential; long-winded information that never changes; "cutesy" graphics, such as lines of asterisks, parentheses, center-screen formatting (in short, save the arts and crafts for 80-meter RTTY); and ego trip and "show-off" messages.

Beacon Timing

There is absolutely no justification for sending a beacon every one, two, or three minutes. In many metropolitan areas, there's little justification for basing the beacon timing to the AFTER routine. On a primary channel like 145.01, there is no harm in an *informative* beacon every 30 minutes—let's face it, that's all the channel can handle without strangling. That's still 48 beacon messages in 24 hours! On auxiliary channels like 145.03, .05, .07, and .09, a beacon every 15 minutes will let the world know you're there. The gang won't find out any faster if the beacon is sent every two minutes.

Once a user has joined a local packet-radio club, or his station has shown up on a packet network map of his area, the rest of the local area users will know who he is, where he is, and in general everything that *they* wish to know about him and his operation. At that point, the beacon will become of less importance, and the beacon intervals can be reduced to simply indicate that the station is in fact alive and well on the channel and available for normal service.

The only constraint on the use of the beacon feature is the requirement for the generous use of ordinary common sense, lightly tempered with some patience on the part of the old packet hands, and a more tolerant, more tutorial approach to the new kids on our packet-radio block. We can't expect them to understand everything about our packet mode the day they first put their packet boxes on the air. The manufacturers' manuals are close to worthless when it comes to instructions on good on-the-air operating practices and procedures.

"Repeated attempts to log on to a PBBS that is already in use will certainly result in winning the 'Most Unpopular User of the Week' award given by area sysops."

Beaconeers and the PBBS

If you want to use a PBBS as a digipeater for your convenience, I'd suggest a bit of common sense and courtesy. For example:

Don't digipeat your beacons through the PBBS! That's not what a PBBS is all about. Digipeat your beacons through someone else. (Beacons are doubly offensive when your system sends them through a PBBS while someone else is trying to download a file or read the mail.)

If you're using the local PBBS as a digipeater, don't stick BELL commands in your stuff unless you have some legitimate reason for ringing someone's bell. I'm referring to the Control-G character. I expect to answer my terminal when it beeps—I get cranky when I see that it's merely another nonsense beacon carrying BELL signals. Baloney!

If your beacon has something important to say, like a club meeting notice, an urgent call for a contact, or anything *other* than another pointless ego trip, send the beacon through some other available digipeater.

Good Manners and the PBBS

For those newcomers who may not be familiar with PBBS operations, please be advised that most PBBSs are *not* multi-user systems, nor can they accept or handle multiple connections. This means, in plain English, *first come, first served!* If you see that the PBBS is already being used by another station when you wish to use the PBBS, you must wait your turn. Your CONNECT REQUEST sent while someone else is logged on will produce the following results:

- You will get the "(PBBS CALLSIGN) BUSY" message and a DISCONNECT.
- The station logged on to the PBBS will see a message on his/her screen stating that "W2XXX just tried to connect" or the like.
- The PBBS sysop will see the same message on the local console screen if he/she happens to be watching.
- The PBBS will issue the "W2XXX just tried to connect" to the channel in general.
- If the logged-on user station happens to be downloading a file to disk, some PBBS systems will place the "W2XXX just tried to connect" in the downloaded file just as though it were a native part of the file. The user will then have to edit the received file or program to remove the junk strings.

Repeated attempts to log on to a PBBS that is already in use will certainly result in winning the "Most Unpopular User of the Week" award given by area sysops. These packet systems, their channels, and the PBBSs are all based on the concept of the "shared resource." Wait your turn to get your share when using a PBBS. If you see the PBBS already sending protocoled packets to another station, wait until the current user has logged off, pause about 30 seconds to permit the PBBS to recycle itself, and then issue the CONNECT REQUEST.

Sorry if this all sounds like a new, "digital" version of the old two-meter "Repeater God" story, but some of the PBBS sysops have as much as $5,000 worth of computers, TNCs, radios, and antennas at your service. It's their station and their legal responsibility. Therefore, any PBBS sysop reserves the right to decide how, when, and by whom his system will be used.

Common sense is all that's required. Try some—it doesn't cost much.

"Coordinated" Packet Channels

There seems to be growing misunderstanding about the use of so-called "packet channels" (145.01, .03, .05, .07, and .09 in many areas).

The practice of sending long programs and files between two packet stations *in direct*

connection indicates that some people may have the impression that packet channels are the *only* channels where packet radio can be used. *This is categorically false!* You can use packet radio on *any* channel on which F1 emissions are authorized. This includes most of two meters. Common sense dictates that you avoid using those repeaters whose user support groups do not desire packet communications on the repeater, as well as observing other gentleman's agreements and band plans, satellite passbands, DX calling frequencies, etc.

If two stations wish to transfer files back and forth and can make direct connection (without a digipeater or other intermediate relay mode), these stations should move off of the "packet channels" to conduct *direct* station-to-station file transfers. In that manner, the limited number of packet channels can remain free for the users who need the available digipeaters or wish to have a comfortable keyboard-to-keyboard chat or move a message in or out of the local PBBS without having to battle the intense, rapid-fire barrage of frames running between the stations involved in the extended file transfers.

It's only common courtesy to operate under the assumption that these packet channels are a shared resource. It's hard to share the channel with two guys who are running with super-tight TNC timings and completely monopolizing the channel with flying fields and frames.

I don't believe that the frequency-coordinating councils intended to imply, nor should any packeteer infer, that packet radio *can only be used* on these coordinated packet channels. This coordination was done to give the growing packet fraternity a "home" separated from the "traditional" voice simplex channels and repeater channels. It also serves as a notice to voice users who want to avoid automated stations using a 40-millisecond window to check to see if the frequency is in use.

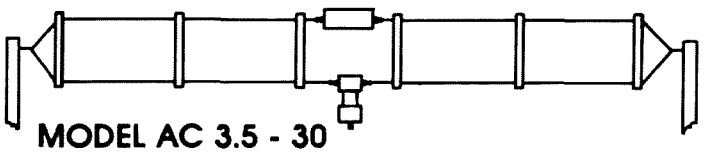
There is absolutely *no reason* why long files cannot be transferred between two stations in direct connection using the simplex channels available throughout the bands—with a bit of care, courtesy, and common sense. You *must* listen on the intended operating channel *before* transmitting. If an SSB or FM voice contact is in progress, the old rules still apply; don't knowingly dump tons of packets on top of a voice communication in progress.

Advanced technology will never be a replacement for courtesy and common sense. The latter talents are sometimes more important than the former.

A Wee Packet Philosophy

It's really up to us to teach each other and help the mode grow in orderly fashion, rather than merely criticize others. Those of us who are fortunate in having more experience and understanding more about packet radio and its unique qualities have a real moral and technical obligation to serve as mentors towards those who know less but want to know more. ■

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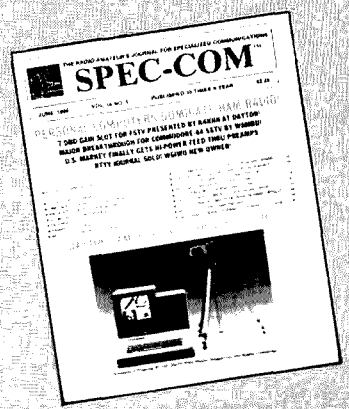
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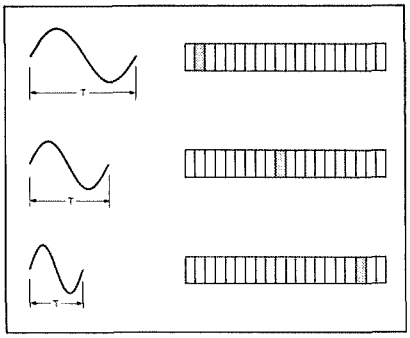


Fig. 1. Appearance of display for a single tone.

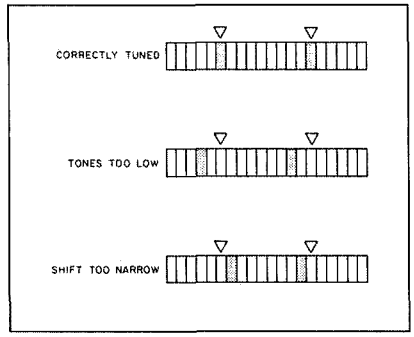


Fig. 2. Appearance of display for AFSK signals.

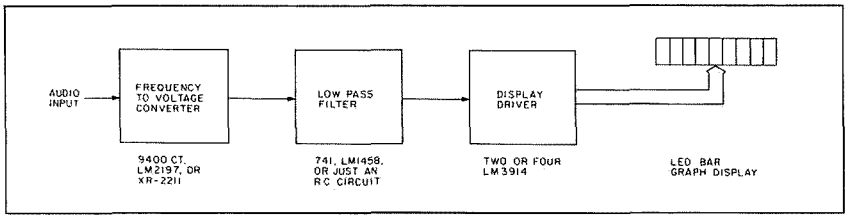


Fig. 3. Block diagram of most analog tuning indicators.

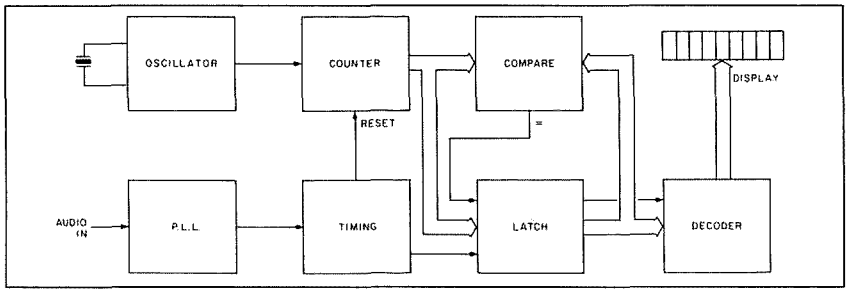


Fig. 4. Block diagram of digital tuning indicator.

Some aspects of RTTY have changed quite a bit during the last 40 years. Toroids, vacuum tubes, and Model 15 Teletypes® have been replaced by integrated circuits. Other things are still the same. Most people are still using 60-word-per-minute Baudot code. And, judging by my observations, most people are still using signal-strength meters, dual-ellipse patterns on oscilloscopes, or just random fiddling with the dial to tune in signals. Two stations conversing are rarely right on the same frequency.

These traditional techniques may be adequate for old-fashioned RTTY, but HF packet is *much* more difficult! Instead of 5-minute monologues, you must catch 1-second bursts on a channel often shared by several concurrent conversations. If you miss a few bits, you don't just get some garbled characters in part of a continuous stream. The whole packet is discarded and you don't know how long it will be until the next one is sent. Tuning, therefore, is more critical. For best results, you should be no more than 20 Hz off frequency. Forget about receiving anything if you're 50 Hz off.

A few years ago, a new type of RTTY tuning indicator appeared. It uses a light-emitting-diode (LED) bar-graph display to indicate the frequency of the incoming audio signal. Fig. 1 illustrates the basic idea. Each LED segment corresponds to a small range of audio tones, typically around 10-to-25-Hz wide. As the audio frequency increases, a different segment farther to the right is activated.

When an audio-frequency-shift-keyed (AFSK) signal is present, two bright spots appear along the display—as shown in Fig. 2. You can see instantly if the tones are too low or too high, and if the shift is correct.

The first device of this type (that I know of) was the Toni-Tuna.[1] (Fig. 3 shows a block diagram.) It uses a frequency-to-voltage converter, a low-pass filter, and some 3914 bar-graph display-driver chips. Recent products such as the HAL SPT-1[2] and AEA TI-1[3] are minor variations of this circuit. The TAPR Tuning Indicator[4] is a little different in that it has a single dot that moves with the average of the minimum and maximum peak frequencies. This has the unfortunate property of producing the same appearance for a steady carrier as for an FSK signal of any shift.

The simplicity and low cost of these analog devices are attractive, but they have some serious shortcomings. To calibrate them, you need a very accurate source of tones such as a signal generator and digital frequency counter. Adjacent LED segments correspond to frequencies that differ by only about 1%. Would you trust a cheap analog circuit to stay well within this tolerance with temperature changes, voltage fluctuations, and component aging?

The TimeKit Blinky[5] looks similar on the outside but works on a much different principle. It has six bandpass filters centered at 1.2, 1.5, 1.7, 1.9, 2.1, and 2.3 kHz, each driving a different LED. With each LED representing at least a 200-Hz range of tones, this has nowhere near the accuracy required for packet.

To overcome the weaknesses of the analog circuits, I built a device with the same type of display but with mostly digital circuitry behind it[6] (see the block diagram in Fig. 4). First, a phase-locked loop (PLL) locks onto the strongest frequency in the audio signal. A crystal-controlled counter measures the period of each cycle, and the corresponding LED segment is activated. The digital approach is far more accurate and does not require calibration. Even with the cheapest crystal, temperature variations, power-supply fluctuations, and component aging, the accuracy is still at least an order of magnitude better than the display resolution.

The digital approach also has a novel feature that really helps clean up the display appearance for noisy signals. The LED numbers for the current and preceding audio cycles are compared. The display is disabled when they are different. Thus, there is less of a tendency to get a blur as the input frequency is changing. The display comes on only when the frequency stays put for a while. The result is a much sharper display for noisy signals.

This article describes an entirely new circuit that operates on the same principle but has the improvements listed below:

1. Fewer chips.
2. Operates on single voltage supply.
3. Uses a cheap and readily available colorburst crystal instead of a different custom crystal for each frequency range.
4. More flexible mapping of the frequency to display segments.
5. The display is blanked with no input signal.
6. More digital processing of the signal to clean up the display appearance.

LED Display Segment Number	EPROM Output For On	EPROM Output For Blanked
1	1110 0000	1111 0000
2	1110 0001	1111 0001
3	1110 0010	1111 0010
.	.	.
.	.	.
.	.	.
15	1110 1110	1111 1110
16	1110 1111	1111 1111
17	1101 0000	1111 0000
18	1011 0001	1111 0001
19	0111 0010	1111 0010

Table 1. Mapping of EPROM output to LED segment selection.

Freq.	Count	LED	EPROM Addr.	Content
	.			
	.			
	.			
	282	4	1000 1101 0xxx	1110 0011
	281	4	1000 1100 1xxx	1110 0011
	280	5	1000 1100 0xxx	1110 0100
1600	279	5	1000 1011 1xxx	1110 0100
	278	5	1000 1011 0xxx	1110 0100
	277	6	1000 1010 1xxx	1110 0101
	.			
	.			
	.			
1800	248	15	0111 1100 0xxx	1110 1110
	.			
	.			
	.			

Table 2. Sample of mapping of frequency to desired LED display segment.

EPROM Start Addr.	LED For Previous Cycle 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	Count	LED	Center Freq.
08e0	f2 f2 e2 f2 f2 f2 f2 f2 !	284	3	1572
08d8	f3 f3 f3 e3 f3 f3 f3 f3 !	283	4	1578
08d0	f3 f3 f3 e3 f3 f3 f3 f3 !	282	4	1583
08c8	f3 f3 f3 e3 f3 f3 f3 f3 !	281	4	1589
08c0	f4 f4 f4 f4 e4 f4 f4 f4 !	280	5	1595
08b8	f4 f4 f4 f4 e4 f4 f4 f4 !	279	5	1600
08b0	f4 f4 f4 f4 e4 f4 f4 f4 !	278	5	1606
08a8	f5 f5 f5 f5 f5 e5 f5 f5 !	277	6	1612
08a0	f5 f5 f5 f5 f5 e5 f5 f5 !	276	6	1618
0898	f5 f5 f5 f5 f5 e5 f5 f5 !	275	6	1624

Table 3. Portion of EPROM contents for blanking when frequency changes. Locations causing display to be enabled are underscored.

Circuit Description

In the upper left corner of Fig. 5, the audio enters U1, a PLL, which tries to track the audio signal. Pin 5 is low when U1 thinks it is locked onto something. The XR-2211 has no voltage-controlled-oscillator (vco) output available outside the chip, so I used U2 to extract it from the timing capacitor.

During most of each audio cycle, U5B and U6 are busy counting away. At the end of the audio cycle, U3 controls the following sequence of events: clear frequency divider (U5A), causing counter (U5B and U6) to stop; enable the EPROM (U7); wait awhile for the counter to settle down; grab the

EPROM Start Addr.	LED For Previous Cycle 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	Count	LED	Center Freq.
08e0	f2 f2 e2 e3 f2 f2 f2 f2 !	284	3	1572
08d8	f3 f3 e2 e2 e3 f3 f3 f3 f3 !	283	4	1578
08d0	f3 f3 f3 e3 f3 f3 f3 f3 !	282	4	1583
08c8	f3 f3 f3 e3 e4 f3 f3 f3 !	281	4	1589
08c0	f4 f4 f4 e3 e4 f4 f4 f4 !	280	5	1595
08b8	f4 f4 f4 f4 e4 f4 f4 f4 !	279	5	1600
08b0	f4 f4 f4 f4 e4 e5 f4 f4 !	278	5	1606
08a8	f5 f5 f5 f5 e4 e5 f5 f5 !	277	6	1612
08a0	f5 f5 f5 f5 f5 e5 f5 f5 !	276	6	1618
0898	f5 f5 f5 f5 f5 e5 e6 f5 !	275	6	1624

Table 4. Hysteresis added to prevent flickering at the boundaries. Locations differing from preceding figure are underscored.

EPROM output in the latch (U8); clear the counter; and start counting for the next audio cycle.

The EPROM maps the count, proportional to the audio cycle period, into the appropriate LED segment. It also does a few other little tricks as we'll see later. Finally, U8 and U9 drive the LED display.

Construction

Fig. 6 contains the pattern for etching a PC board for those who wish to make their own. Fig. 7 contains the parts placement guide. Note that six jumpers are required. One of them has one end in either the JP1 or the JP2 hole depending on the input frequency range. If you have an extra 200 milliamps of 5 volts available, U10 can be bypassed. Otherwise, the unit can be powered from your 12-volt

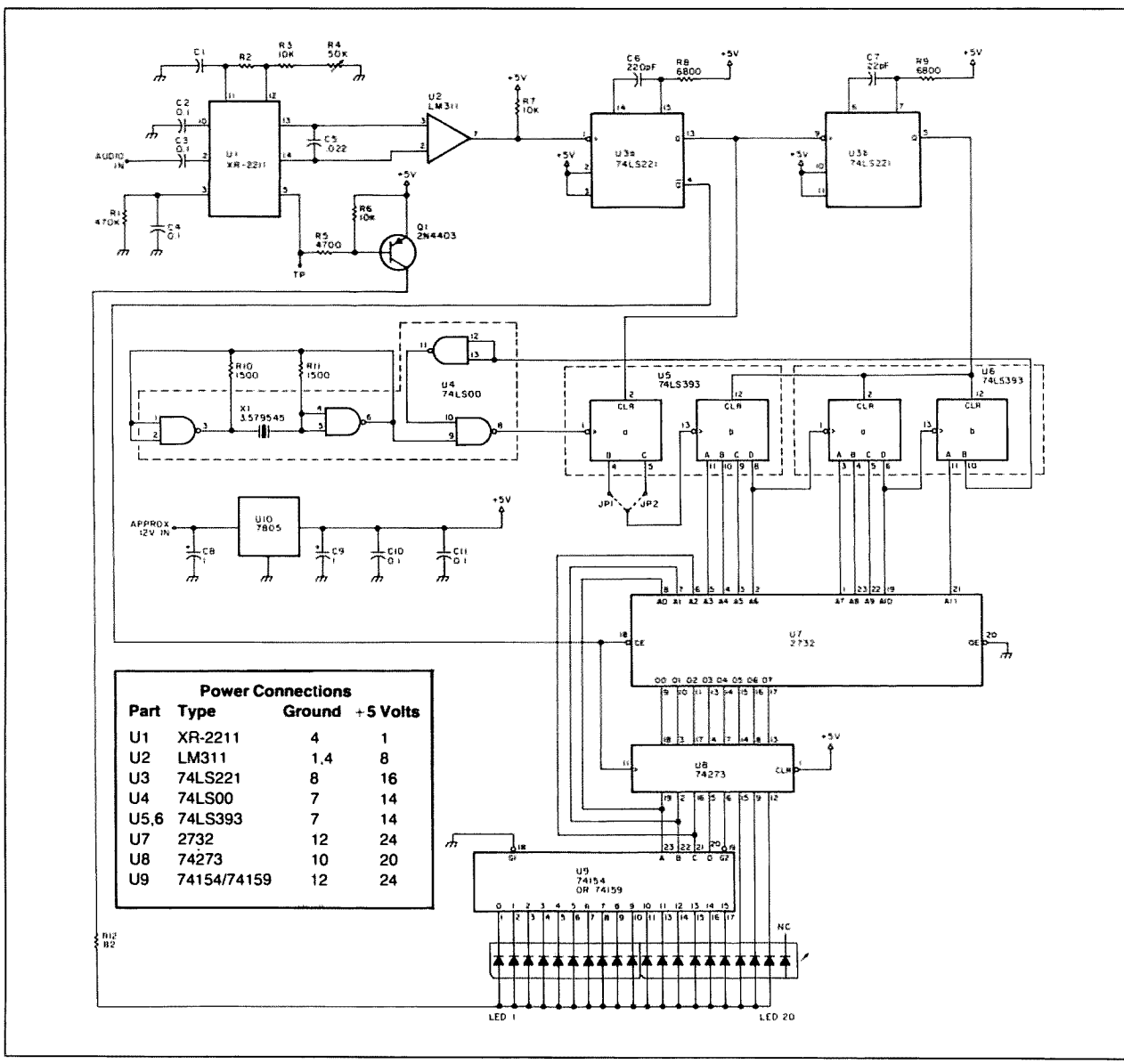


Fig. 5. Schematic.

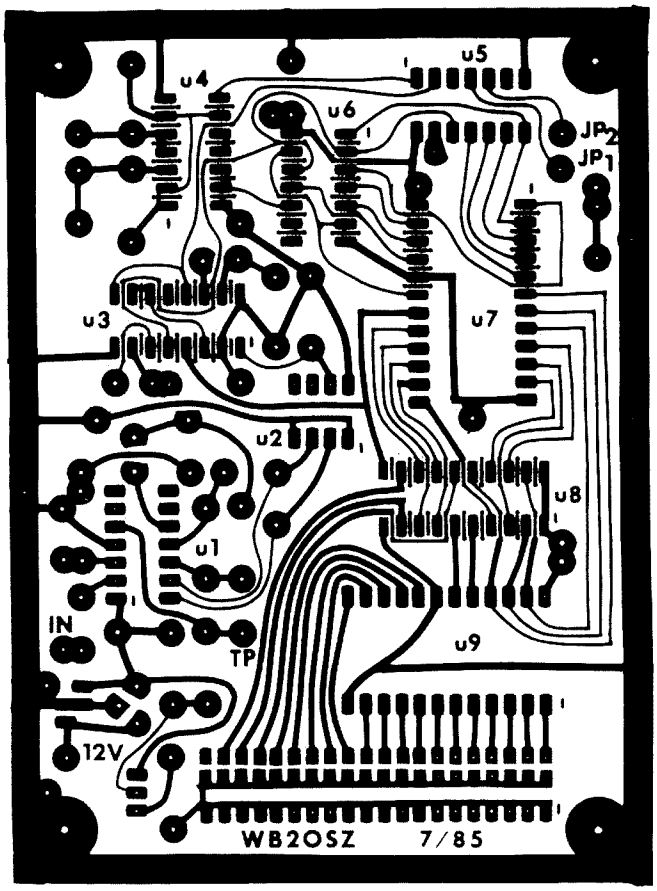


Fig. 6. Full-size pattern for single-sided PC board.

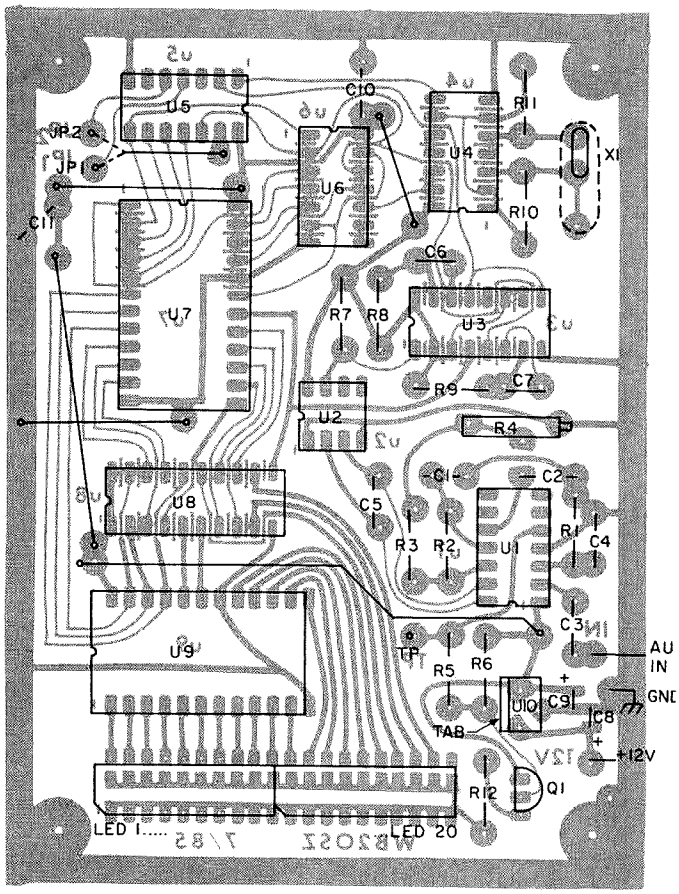


Fig. 7. Parts placement guide.

transceiver supply, or a separate supply can be constructed (Fig. 8).

The PC board has an extra hole, so a crystal in either an HC18/U or an HC33/U holder can be used. There is also an extra row of holes, so the LED displays can be mounted flat on the board or on right-angle sockets. I constructed a 40-pin right-angle socket from three 16-pin right-angle sockets, using a saw, a file, and some glue. Some may wish to build a larger display with different colors of discrete LEDs.[7] A few people wrote to me and reported that it makes a more dramatic display.

Mostly 74LS parts were used instead of regular TTL, for reduced power consumption. U8 and U9 are exceptions, because more current-sink capability is required to drive the display. Pay particular attention to the orientation of the ICs; they go in all different directions. Be sure to use mylar™ and mica capacitors where indicated in the parts list. Disc ceramic capacitors are very unstable and should not be used in timing circuits where accuracy is important.

The EPROM

In this section, I'll try to retrace the thought process that went into generating the data for the EPROM. It can get rather tedious. If you get lost, just skip to the next section.

First, let's look at the required EPROM output for selecting each of the LED segments. The four high-order bits (07–04) from the EPROM are enable signals. A logic zero at bit 7, 6, or 5 activates LED segment 19, 18, or 17, respectively. When bit 4 is zero, U9 selects one of the remaining LEDs based on the four low-order bits.

Thus, LEDs 1 through 16 are selected by the bit pattern 1110nnnn, where nnnn is 0000 through 1111. LEDs 17, 18, and 19 are selected by 1101xxxx, 1011xxxx, and 0111xxxx, respectively, where xxxx doesn't matter. Note that the low-order bits in the middle column of Table 1 continue to be incremented for a reason to be explained later. The final column is the same except all the enable signals have been set to 1. These are for cases in which the display should be blanked. The low-order bits still contain a hint as to which LED would have been on if the display hadn't been blanked.

The next step is to fill in the proper EPROM locations with values from the preceding chart. Let's take the 1600/1800-Hz tone pair as an example. I decided arbitrarily that LEDs 5 and 15 should correspond to these audio frequencies and placed small triangular pieces of plastic tape above them on the display.

When the crystal frequency is divided by 8 (by U5A), divided again by the audio input of 1600 Hz, and rounded to the nearest integer, you would expect a count of 280. Actually, a slight correction must be made to compensate for the clock cycles not counted while the one-shots are active, so the real count is 279. Similarly, a count of 248 is obtained for 1800-Hz input. The EPROM locations for a count of 279 are filled with the pattern to activate LED 5. The bit pattern for LED 15 is placed in locations for a count of 248. From here, some interpolation and extrapolation was used to fill in other nearby locations (Table 2).

After repeating the process for four other

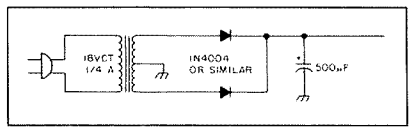


Fig. 8. Ac power supply for use when roughly 12 V dc is not available.

Modem Tones	Dial for USB	Dial for LSB
1070/1270	14,100.13	14,102.47
1600/1800	14,099.60	14,103.00
2025/2225	14,099.175	14,103.425

Table 5. Dial settings for USB and LSB.

common tone pairs, I plotted the data to make a visual check and made some more minor adjustments. The result is in Fig. 9. All of this was done before the circuit was built.

By now you're probably wondering why there are eight memory locations for each count. The next evolutionary step was to add blanking while the input frequency was changing. The goal was to enable the display only when the same LED was selected for two consecutive audio cycles. The result is bright spots where the frequency stays still for a while and dimming of the blur as it moves around.

Note that the three low-order bits of the previous LED number are used as the low-order bits of the EPROM address. Table 3 illustrates the new contents. Hexadecimal notation has replaced the binary to make the chart more compact. For a count of 278 through 280, LED 5 is the desired result. Note, however, that the display is enabled (output e3) only if LED 5 or 13 was selected the previous time. My original circuit used a 7485 to compare the low-order four bits of the LED number. In my observations, it looked as if the PLL couldn't move that far in one audio cycle; so, in practice, comparing only the three low-order bits is adequate. Doubling the EPROM size and comparing the four low-order bits would be a worthwhile experiment, especially if the PLL was modified to track higher data rates.

Finally, a tone right on the edge between two LED segments would result in flickering. I added a small amount of hysteresis, so a frequency right at a boundary would stay with one LED or the other (Table 4).

Fig. 10 contains a complete annotated copy of the EPROM data in Intel Hex Format. Each line contains a colon to indicate the beginning of a record, two hexadecimal digits for the data byte count (always 08 in this case), four hexadecimal digits for the starting address, two zeros for the record type, a variable number of data bytes, and two hexadecimal digits for a checksum. Anything preceded by an exclamation mark is a comment. These comments will probably have to be removed before feeding this data into most EPROM programming systems.

The Weak Link

The weakest link of the whole system is the phase-locked loop. Following the spec sheet and application notes, I first tried 150k and .0047 uF for R2 and C1. This resulted in very poor tracking of the audio signal. The loop was under-damped, resulting in excessive overshooting of the input frequency. After recomputing C1 for critical damping, the vco was rather sluggish about tracking shifts in frequency.

After lots of experimentation, 47k and .0025 uF seemed to be a good compromise for several tone pairs. All the experimentation up to this point had been done with a locally generated 300-baud AFSK signal. It did not work well at all with real signals from a radio.

After more tweaking, testing, and fiddling,

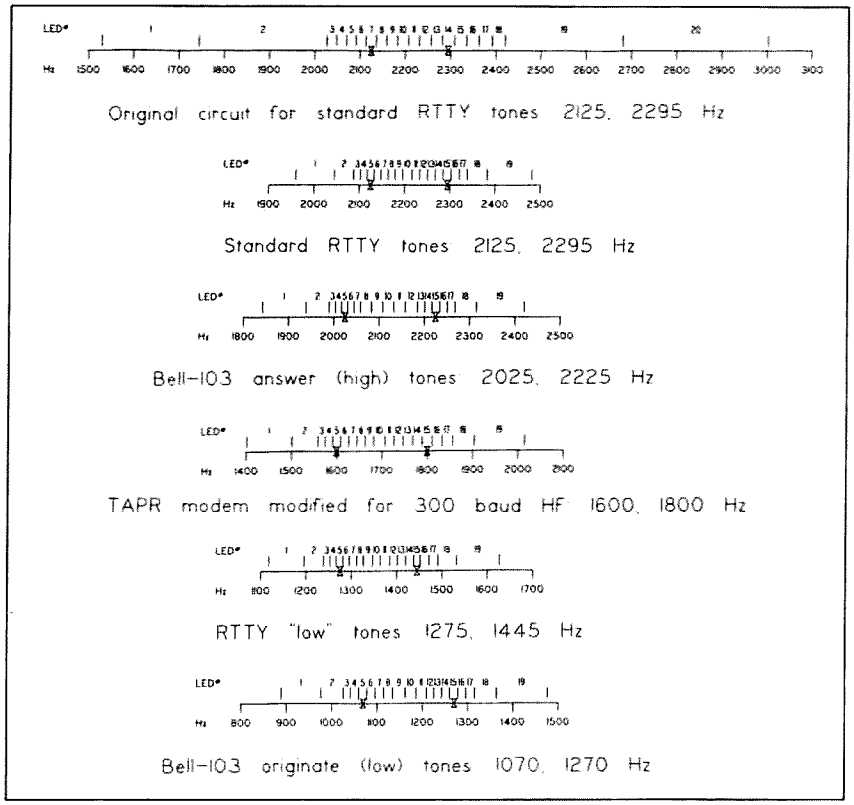


Fig. 9. Frequency ranges of LEDs.

Parts List

C1	.002-uF mylar or mica
C2, 3, 4, 10, 11	0.1-uF disc ceramic
C5	.022-uF mylar
C6	220-pF mica
C7	22-pF mica
C8, 9	1-uF tantalum
LED1-20	Two 10-segment LED bar-graph displays such as MV57164
Q1	2N4403 or similar PNP
R1	470k
R2	120k
R3, 6, 7	10k
R4	50k multi-turn pot
R5	4,700 Ohms
R8, 9	6,800 Ohms
R10, 11	1,500 Ohms
R12	82 Ohms
U1	XR-2211, FSK Demodulator/Tone Decoder
U2	LM 311, Comparitor
U3	74LS221, Dual monostable multi-vibrator
U4	74LS00, Quadruple 2-input NAND
U5, 6	74LS393, Dual 4-bit binary counter
U7	2732, Erasable Programmable Read Only Memory (Available for $8 from author. Be sure to specify one of the five tone pairs desired from Fig. 9.)
U8	74273, Octal D-type flip-flops
U9	74154 or 74159, 4-line-to-16-line decoder
U10	7805, 5-volt regulator
X1	3.579545-MHz color-burst crystal
misc.	Heat sink for U10 Socket for U7 Optional right-angle sockets for LEDs

subjective decisions about display cleanliness, and playing the same recording of packet signals over and over, I finally settled on 120k and .002 uF. R2 basically sets the bandwidth. Too much bandwidth (smaller R2) makes the PLL overly responsive to the noise. Too little makes the PLL too sluggish about following the desired signal. C1 sets the damping factor. If CI is too big, the vco frequency overshoots and rings when the input frequency suddenly jumps. If too small, the PLL doesn't follow the changes fast enough.

Note that I was optimizing for 300-baud operation. A slightly larger resistor or smaller capacitor would probably improve performance for lower-speed RTTY.

Adjustment

Connect the audio input to ground. Also connect the test point (TP) to ground. Adjust R4 until LED number 10 is lit. Disconnect the two points connected to ground earlier. That's all! Never worry about it again. Any minor drifting of the PLL center frequency will not affect the accuracy of the device.

Installation

Fig. 2 shows the ideal case of a perfect signal coming right out of a signal generator. A real signal from an HF transceiver has plenty of noise and distortion that will cause the cleanliness of the display to deteriorate. If you connect the tuning indicator directly to the speaker, a pleasant display will be obtained only for a fairly strong and clean signal. For more typical signals, the audio must be cleaned up.

All good quality RTTY terminal units (or packet modems) start with a bandpass filter to select the frequency range of interest and attenuate the rest. After this bandpass filter is the proper place to connect the tuning indicator. If you are using a TAPR TNC-1 or one of the many clones, obtain the signal from pin 1 of U20. This is the output of the low-pass filter after the switched capacitor bandpass filter. If you're in doubt as to where to make the connection to your system, send me a copy of the modem schematic and an SASE.

(Note: Simple PLL demodulators such as this enjoyed a brief popularity on RTTY a few years ago. Soon, most people realized they just didn't work very well with noisy HF signals and went back to the good old-fashioned designs with separate mark and space filters. The packet crowd had to rediscover this fact, and only recently have packet equipment manufacturers begun to offer better quality modems for HF use.)

HF Packet Frequency Specification

Suppose you were having a RTTY QSO with someone in England. Your transceiver's display says 14,085.00 kHz. What would be displayed on his transceiver? Probably 14,081.43—more than 3.5 kHz different! How can this be?

Almost all amateur HF RTTY uses 170-Hz frequency shift keying (FSK). This is usually produced by generating an audio-frequency-

Fig. 10. Complete EPROM contents for use with 1600/1800-Hz tones.

```
! TAPR modem modified for 300 baud HF: 1600, 1800 Hz
! Use Jumper position JP2.

! All unused locations contain FF.
!
!  addr  data...          cs      count   LED  center freq
:0809f000e0f0f0f0f0f0f0f08f  !   318     1    1404
:0809e800e0f0f0f0f0f0f0f097  !   317     1    1409
:0809e000e0f0f0f0f0f0f0f09f  !   316     1    1413
:0809d800e0f0f0f0f0f0f0f0a7  !   315     1    1418
:0809d000e0f0f0f0f0f0f0f0af  !   314     1    1422
:0809c800e0f0f0f0f0f0f0f0b7  !   313     1    1427
:0809c000e0f0f0f0f0f0f0f0bf  !   312     1    1431
:0809b800e0f0f0f0f0f0f0f0c7  !   311     1    1436
:0809b000e0f0f0f0f0f0f0f0cf  !   310     1    1441
:0809a800e0f0f0f0f0f0f0f0d7  !   309     1    1445
:0809a000e0f0f0f0f0f0f0f0df  !   308     1    1450
:08099800e0f0f0f0f0f0f0f0e7  !   307     1    1455
:08099000e0f0f0f0f0f0f0f0ef  !   306     1    1459
:08098800e0f0f0f0f0f0f0f0f7  !   305     1    1464
:08098000e0f0f0f0f0f0f0f0ff  !   304     1    1469
:08097800e0f0f0f0f0f0f0f007  !   303     1    1474
:08097000e0f0f0f0f0f0f0f00f  !   302     1    1479
:08096800e0f0f0f0f0f0f0f017  !   301     1    1484
:08096000e0f0f0f0f0f0f0f01f  !   300     1    1488
:08095800e0f0f0f0f0f0f0f027  !   299     1    1493
:08095000e0e1f0f0f0f0f0f03e  !   298     1    1498
:08094800e0e1f1f1f1f1f1f140  !   297     2    1504
:08094000f1e1f1f1f1f1f1f137  !   296     2    1509
:08093800f1e1f1f1f1f1f1f13f  !   295     2    1514
:08093000f1e1f1f1f1f1f1f147  !   294     2    1519
:08092800f1e1f1f1f1f1f1f14f  !   293     2    1524
:08092000f1e1f1f1f1f1f1f157  !   292     2    1529
:08091800f1e1f1f1f1f1f1f15f  !   291     2    1534
:08091000f1e1f1f1f1f1f1f167  !   290     2    1540
:08090800f1e1f1f1f1f1f1f16f  !   289     2    1545
:08090000f1e1f1f1f1f1f1f177  !   288     2    1550
:0808f800f1e1e2f1f1f1f1f18f  !   287     2    1556
:0808f000f2e1e2f2f2f2f2f291  !   286     3    1561
:0808e800f2f2e2f2f2f2f2f288  !   285     3    1567
:0808e000f2f2e2e3f2f2f2f29f  !   284     3    1572
:0808d800f3f3e2e3f3f3f3f3a1  !   283     4    1578
:0808d000f3f3f3e3f3f3f3f398  !   282     4    1583
:0808c800f3f3f3e3e4f3f3f3af  !   281     4    1589
:0808c000f4f4f4e3e4f4f4f4b1  !   280     5    1595    X
:0808b800f4f4f4f4e4f4f4f4a8  !   279     5    1600    X
:0808b000f4f4f4f4e4e5f4f4bf  !   278     5    1606    X
:0808a800f5f5f5f5e4e5f5f5c1  !   277     6    1612
:0808a000f5f5f5f5f5e5f5f5b8  !   276     6    1618
:08089800f5f5f5f5f5e5e6f5cf  !   275     6    1624
:08089000f6f6f6f6f6e5e6f6d1  !   274     7    1630
:08088800f6f6f6f6f6f6e6f6c8  !   273     7    1635
:08088000f6f6f6f6f6f6e6e7df  !   272     7    1641
:08087800f7f7f7f7f7f7e6e7e1  !   271     8    1648
:08087000f7f7f7f7f7f7f7e7d8  !   270     8    1654
:08086800e8f7f7f7f7f7f7e7ef  !   269     8    1660
:08086000e8f8f8f8f8f8f8e7f1  !   268     9    1666
:08085800e8f8f8f8f8f8f8f8e8  !   267     9    1672
:08085000e8e9f8f8f8f8f8f8ff  !   266     9    1678
:08084800e8e9f9f9f9f9f9f901  !   265    10    1685
:08084000f9e9f9f9f9f9f9f9f8  !   264    10    1691
:08083800f9e9f9f9f9f9f9f900  !   263    10    1698
:08083000f9e9eaf9f9f9f9f917  !   262    10    1704
:08082800fae9eafafafafafa19  !   261    11    1711
:08082000fafaeafafafafafa10  !   260    11    1717
:08081800fafaeaebfafafafa27  !   259    11    1724
:08081000fbfbeaebfbfbfbfb29  !   258    12    1730
:08080800fbfbfbebfbfbfbfb20  !   257    12    1737
:08080000fbfbfbebecfbfbfb37  !   256    12    1744
:0807f800fcfcfcebecfcfcfc3a  !   255    13    1751
:0807f000fcfcfcfcecfcfcfc31  !   254    13    1758
:0807e800fcfcfcfcecedfcfc48  !   253    13    1765
:0807e000fdfdfdfdecedfdfd4a  !   252    14    1772
```

```
:0807d800fdfdfdfdfdedfdfd41  !   251   14   1779
:0807d000fdfdfdfdfdedeefd58  !   250   14   1786
:0807c800fefefefefeedeefe5a  !   249   15   1793   X
:0807c000fefefefefefeeefe51  !   248   15   1800   X
:0807b800fefefefefefeeeef68  !   247   15   1807   X
:0807b000ffffffffffffeeef6a  !   246   16   1815
:0807a800ffffffffffffffef61  !   245   16   1822
:0807a000d0ffffffffffffef98  !   244   16   1830
:0807980dd0f0f0f0f0f0f0effa  !   243   17   1837
:0807900dd0f0f0f0f0f0f0f001  !   242   17   1845
:0807880dd0b1f0f0f0f0f0f048  !   241   17   1852
:0807800dd0b1f1f1f1f1f1f14a  !   240   18   1860
:0807780df1b1f1f1f1f1f1f131  !   239   18   1868
:0807700df1b1f1f1f1f1f1f139  !   238   18   1876
:0807680df1b1f1f1f1f1f1f141  !   237   18   1883
:0807600df1b1f1f1f1f1f1f149  !   236   18   1891
:0807580df1b172f1f1f1f1f1d0  !   235   18   1899
:0807500df2b172f2f2f2f2f2d2  !   234   19   1908
:0807480df2f272f2f2f2f2f299  !   233   19   1916
:0807400df2f272f2f2f2f2f2a1  !   232   19   1924
:0807380df2f272f2f2f2f2f2a9  !   231   19   1932
:0807300df2f272f2f2f2f2f2b1  !   230   19   1941
:0807280df2f272f2f2f2f2f2b9  !   229   19   1949
:0807200df2f272f2f2f2f2f2c1  !   228   19   1958
:0807180df2f272f2f2f2f2f2c9  !   227   19   1966
:0807100df2f272f2f2f2f2f2d1  !   226   19   1975
:0807080df2f272f2f2f2f2f2d9  !   225   19   1984
:0807000df2f272f2f2f2f2f2e1  !   224   19   1993
:0806f800f2f272f2f2f2f2f2ea  !   223   19   2001
:00000001ff
```

shifted signal and feeding it into an SSB transmitter. By convention, the *higher* radio frequency is the "mark" frequency (idle or data "1"). In the United States, audio tones of 2125 and 2295 Hz are most common. The *lower* audio frequency is the mark tone. To make this correspond to the higher radio frequency, the LSB mode is used. In some other parts of the world, audio tones of 1275 and 1445 are more common. In this case the *higher* tone is mark so USB is used.[8]

Both stations are operating on the same frequency, but their transceivers indicate different frequencies. How can frequencies be described for skeds, nets, or other purposes? The common solution is to specify the radio frequency of the mark state. Taking the earlier example, 14,085.00 − 2.125 = 14,082.875. For the other station, 14,081.43 + 1.445 = 14,082.875, which is the same. Each station performs the required calculation for its particular audio tones and USB/LSB mode.

We have a similar problem with HF packet, which has suddenly become very popular. Like RTTY, it is usually transmitted by feeding an AFSK signal into an SSB transceiver. I've heard of people using 170-, 200-, 600-, and 1000-Hz shift, but 200 seems to be by far the most popular. Some people are using Bell 103 type modems with 2025 and 2225 tones (or 1070/1270). Others are using modified TAPR modems with TAPR's suggested 1600- and 1800-Hz tones. Many are using LSB. Some may be using USB. These are all compatible as long as the shift and baud rate are the same. Packet radio doesn't really have absolute "mark" and "space" states. The encoding scheme uses transitions and lack of transitions to convey a 0 and 1, respectively. Therefore, your signal can never be "upside down," as is possible with RTTY.

How would you set your transceiver to meet another station at 14,101.3 kHz? From the previous discussion, it should be clear that several packet stations all with the same numbers on their displays could be sending signals on significantly different frequencies. As with RTTY, the obvious solution is to specify the actual radio frequency rather than the dial setting. Each operator would then make the necessary adjustment for his particular audio modem tones and sideband setting.

Should the higher or lower frequency arbitrarily be picked as the signal frequency? As mentioned earlier, there isn't one frequency that is the "mark" or idle state. It seems to me that using the midpoint between them would make the most sense. When using USB, subtract the average of your modem tones from the signal frequency to get the dial setting. When using LSB, add, instead. Using 14,101.3 again as an example, the settings in Table 5 would be used.

Conclusion

Just so no one is misled, I'd like to reiterate the fact that the display will not look like the ideal case in Fig. 2 unless you connect the tuning indicator to a local AFSK generator. The various types of noise and distortion introduced by the HF radio link will cause some blurring of the bright spots and random flickering in other LED segments.

And now the big question: Why use this circuit instead of the simpler analog variety? The much greater accuracy (without any calibration required!) and greater flexibility of the digital approach sound great, but how do they work under actual operating conditions? To find out, I breadboarded an exact copy of one of the commercial products mentioned earlier to make a side-by-side comparison. With some 20-meter RTTY, there wasn't a lot of difference.

Next I located some 300-baud packet activity, and I was very pleased with the results. My circuit produced two very distinct bright spots, with some smearing across a few LED segments, and a little random flickering all over from the noise. Overall, the display had a good contrast, and it was very easy to tune in signals within 10 or 20 Hz. The commercial unit clone had a solid blur across most of the display. Some spots close to the ends of the blur were brighter than the rest, but there really wasn't much contrast. ■

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BUILD THE KIT

A complete kit of parts, including a high-quality double-sided printed circuit board, is available from Valley Electronics. The kit version is slightly different from the unit presented in this article; a larger EPROM is used which covers two frequency pairs, and several cosmetic changes have been made to the PCB.

Order Number	Description	Price
88601	Digital Tuning Indicator kit	$79.95
88602	Kit without enclosure	$72.95
88603	Semi-kit—PCB and EPROMS only	$22.95

All prices include shipping and handling.

Send your check or money order to Valley Electronics, PO Box 1101, Hillsboro NH 03244.

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Seeing Packet Radio With Different Eyes

The Versabraille II system allows blind hams to get connected.

A man sits with his hands resting lightly on his plastic-like display, his TAPR TNC-2 by his side, waiting for his first real contact on packet. Finally, it comes through! He races his hands across the display with eager anticipation of knowing who it is! He sees "CONNECTED TO N7ERZ." He has finally reached his goal in amateur radio—to be able to communicate with other hams through the latest and greatest digital communication mode.

Hello to all of you fellow packeteers. I have written this article to tell you of a recent development for the blind regarding this new mode of digital communication, known by all of us as packet radio. Through the latest computer technology, Telesensory Systems, Inc., has enhanced character-oriented communications for blind users with its Versabraille II system. The system is both a word processor and a communications terminal. Its great flexibility allows for easy use with almost any TNC. It has a disk-based operating system for easy and fast access. I'll first take a look at the technical aspects of the Versabraille II before relating it to packet.



Photo A. The author and AG7H demonstrate packet-by-feel.

The computer is smaller than you would expect: 15" x 10" x 3", and its approximate weight is 10 pounds. The display is the strip just above the keyboard. It is only 20 characters wide, not quite the typical 80 columns offered by screen monitors. The 120 pins that make up the output serve as the link to the outside world for the blind user by means of touch. The pins are displayed in a typical braille-cell formation. The braille cell consists of six dots, which make up all letters, numbers, punctuation, etc. The pins move up and down, much like a dot-matrix print head.

But wait, if you sit down and try to figure out how many combinations you can have with six dots, you realize it is not nearly enough for the wide range of control characters and higher ASCII values that are used in packet communications. Therefore, the Versabraille II uses an outstanding translation program that allows the blind user to use shifted and chorded characters (one with which the space bar is simultaneously depressed along with its braille character) to produce all 128 standard ASCII values.

As for the brain of this machine, the Versabraille II system uses a CMOS Intel 8085 CPU and a 96K memory system. The user has 32,752 bytes available; the rest of the memory space is used for ROM program storage.

Now we know how the braille is shown. But how does one put characters into it? This is done by the keyboard just below the display. It is a rubberbrane-type keyboard. This is very nice, for it allows for almost silent typing. Twenty-four keys make up its foundation. Six of these are used to produce the six braille characters. To the left of these keys is an additional set of 12 keys, the numeric keypad. These keys are used for certain editing features and for fast numeric input. Just slightly above the braille display and to the left are the cursor control keys. Since the computer is menu-driven, these keys select menu items. They are also used to

move a page of text through the 20-character window. And then, of course, there is the space bar.

On the back panel, there are two standard RS-232 interface ports, one for DTE (data terminal equipment) and the other for DCE (data computer equipment). This is the place where a TNC is connected to the Versabraille system. The braille computer has a standard female 25-pin connector, so I cabled it and my TNC-2 together by using a double-male cable. That is all the interface takes as far as hardware is concerned.

The computer can be configured to connect to a number of different types of devices, so care must be taken when setting all the parameters. Baud rate, data bits, stop bits, duplex, parity, device control character input (DC IN), device control character output (DC OUT), DTR, DSR, CTS, and RTS are the basic parameters that most computers deal with. Many other parameters control the way the Versabraille's display translator will interpret incoming data. After all parameters are set correctly, communication with the TNC is possible.

Versabraille and the TNC

I knew that my Versabraille computer would work fine with a TNC; the only thing I lacked was a TNC. Where would I get one? How? The answer came soon after I attended the annual meeting of Tucson Amateur Packet Radio, otherwise known as TAPR. I gave a demonstration of braille packet there, using a friend's TNC along with the Versabraille II. Little did I know that this demonstration would produce a big return on the investment of my time and effort. I was nearly speechless when I received a call from a very good friend who started me in all of this packet venturing. He exclaimed, "Jeff, your dream has come true. TAPR is donating a TNC-2 board to you!"

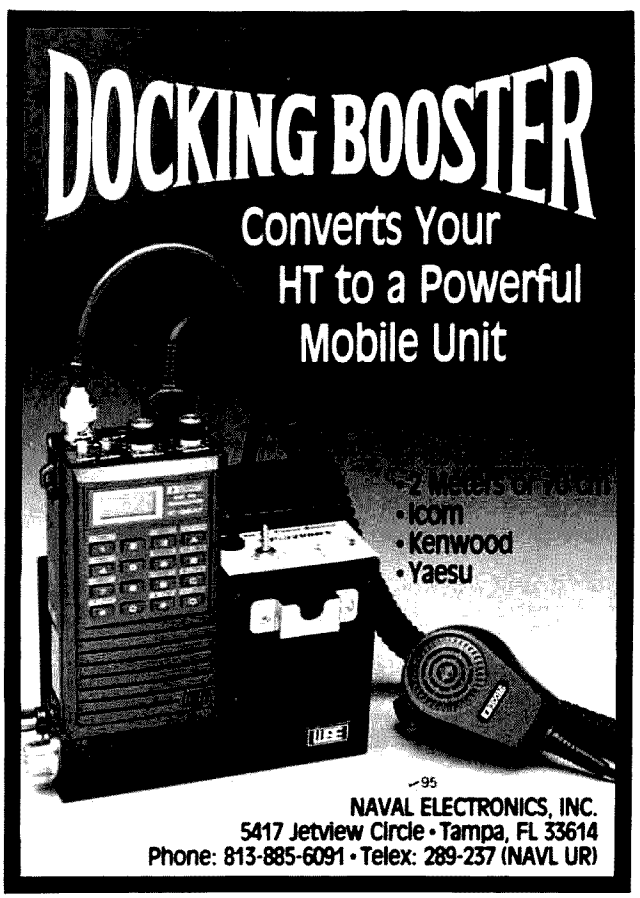
My heart leaped with joy after hearing the news, but deep inside it still did not seem real to me. When Lyle Johnson, President of TAPR, arrived one afternoon with my TNC-2 in hand, I finally knew that the door had been opened for new and exciting challenges. It was like a new beginning of the hobby—as though I just got a new ticket. TAPR wants me to develop interface software so that other blind operators can easily participate in packet radio.

The Versabraille comes with a terminal-emulation package, which connects the display and keyboard to the serial port. I can read the display fast enough to keep up with packet conversations at 1200 baud. But soon after becoming quite experienced with the board, I found that I wanted to communicate at a faster baud rate between the braille computer and the TNC. The problem is that at 9600 baud, the braille cells would just jump out of my reach, requiring me to constantly scroll through the 9K data buffer. One of my first goals is to write a program to remove the callsigns from monitored text, to speed up my reading.

But overall, no big problems have arrived. Many people have asked me why I use braille, why not just use a synthesizer. This may be a much cheaper route to take (a complete Versabraille system costs about $6,000), but after having some experience with packet using a voice synthesizer, I find it to be quite inadequate for such high-speed communication. It takes away the realism of some of packet's most outstanding features. Some of the technical data files on bulletin board systems are not easily "spoken"—a network map, for example. If you are interested in technical information on interfacing a TNC to your synthesizer, please contact me.

These two ways of using packet radio for the blind are just a beginning. Our growing technology promises more and exciting possibilities for all. If any of you would like more information regarding the Versabraille II system, please contact me. I would be happy to share ideas with you. Let us all put our heads together and tackle this new venture. Who knows, since the Versabraille II is completely programmable, the possibilities are almost endless. Remember, feeling is believing.

I would like to thank the man who made my dream reality—Ron Bates AG7H. If it were not for him, this whole venture would still be a dream. He has also helped with technical guidance regarding the hardware interfacing of the computer and the TNC-2. Thanks again, Ron. ■





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So You Want To Be A Sysop?

It's not as easy as it looks.

Nothing has more potential for adding to a packet network than a packet bulletin-board system (BBS). On the other hand, nothing can cause more trouble for a packet network than a BBS. The impact—good or bad—is determined by the skill, planning, and investment of time and funds of the system operator (sysop).

This article describes some of the trials, tribulations, frustrations, and rewards of being a packet BBS sysop. Although written primarily for those considering setting up a BBS, it will also be useful to those who use the BBSs—both to improve their skills as users and to give them some idea of what a sysop has to do to keep the system operating.

Decision Time

Becoming a packet BBS sysop requires a lot more than buying a computer, wiring it up to a TNC, throwing in a couple of disks, and dialing 145.01 on your rig. In many areas where packet is growing at an amazing rate, frequency time is becoming a valuable commodity and a badly operated BBS can do considerably more harm than good.

Before you embark on setting up a BBS, some planning is in order. You have to look at the packet activity in your area and decide how you can best enhance it with your BBS. The following are several things to be considered:

What user group are you serving?

Who is going to be served by your BBS? What need is there for the system you want to establish? If you are going to be the only system in your area, the answer may be obvious. If you represent a certain group of hams who will use it, that's easy, too. But if you already have one or more local BBSs, what is your system going to add? Are there people out there who need your system? What are they looking for? Is there already a good mail/message service? Do you have access to information that others don't have? Do you have HF equipment that will let you set up a gateway?

Sit down before you start and map out the objectives of your station. It will help you decide how to configure and operate it.

What frequency is best?

What frequency (or frequencies) are you going to use? Where is most of the packet activity currently located? If you set up on the main frequency, are you going to increase the traffic unbearably? Are there other BBSs on that frequency that operate frequently? If so, there's a good possibility that you'll spend most of your time colliding with each other and nothing will get through. Maybe the best



Photo A. Typical WØRLI/WA7MBL BBS and gateway station. The station includes an IBM-PC clone, two TNCs, a VHF radio, and an HF radio. This is WB6KAJ-1, run by Lee Dusbabek.



Photo B. Closeup of the station pictured in Photo A. The center box is the AEA PM-1 HF modem. Many HF stations are discovering that a modem optimized for HF operations makes a big difference in the number of packets heard without retries. Modified RTTY TUs have also been used with success. The modem included with most TNCs is either a generic PLL-type design or a modem chip designed for telephone use. In some cases, performance of these modems on a noisy HF link is marginal.

thing is to find another frequency and give local users an alternative.

How are you going to forward mail to other BBSs? What frequencies are now used in your network? Can you access those frequencies while operating on others? Do you need to invest in a second TNC and rig to let you forward on one frequency while handling most of your users on another?

Is there a packet frequency-coordination plan in effect for your area? If so, does your planned operation agree with those allocations? Have you notified the frequency-coordination group that you want to put up a BBS? Do you have to?

What services are you going to provide?

Packet radio BBSs can provide a number of different services to their users. What services are you going to provide to yours? I'll discuss the options later in this article.

Being a Good Sysop

There are several things to consider before taking your checkbook in hand and wandering off to the nearest computerfest. When you put a BBS station on the air, you're taking on a responsibility to the other BBSs and packet users in your area. You're going to put a computer, which can blast out packets at a fantastic rate, on a scarce frequency that others are trying to use for their own communications. You're going to make a system available that, with poor planning on your part or because of an uninformed user, can virtually block a frequency from other use. In my view, you have taken part of a resource that belongs to others, so you have to give something back to make it an even trade.

There are a number of things that I believe a sysop has to do to provide a positive contribution to a packet network. Some of these are:

Enhance, not harm, packet communications.

Make sure that you operate your BBS so it enhances the capabilities of the network. This means conserving precious frequency time. Don't let your BBS spout off a 10-line greeting to everyone who connects. Don't send a 7-line beacon with your name, call, location, and last connect date. Keep your prompts, menus, and commands as short as possible. Remember—while you're sending a 10-line log-on message, someone else is waiting on the frequency for a response from the packet he just sent to his friend across town.

Also, be sure that you have the proper TNC settings for BBS use. I'll discuss these settings later on. Keep in mind that with improper TNC settings, a computer can tie up a frequency and allow *nothing* else to get through. If you do this too often, you'll wind up being hated by every packet operator in your area. Realize that on a common frequency, the BBS should have *lowest priority*.

Deliver the mail.

When you put up a BBS that supports user-to-user messages, you're inviting users to place their traffic there and you're promising

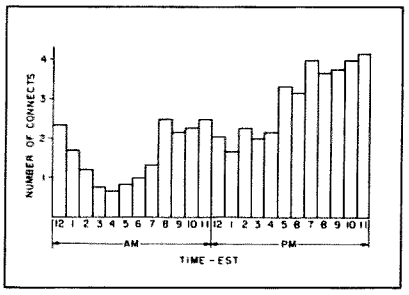


Fig. 1. Most BBS systems are up 24 hours a day. This graph shows the average number of connects by time of day at WB2MNF in March of 1986. The average connect time was 7.7 minutes.

to make your best effort to deliver it. You aren't the U.S. Postal Service, but you shouldn't entice users to leave mail on your system and then not make sure that it gets delivered.

The BBS has to be available when people want to use it. In my experience, this means 24 hours a day, every day. If you decide to put your BBS up during the day, but take it down at night when you need the computer, you'll prevent mail that users have placed there from being delivered. Part-time BBSs aren't effective—people can't use them reliably. If you want to be a good sysop, you have to dedicate a computer to the BBS. This may not mean that you can't use it for something else at the same time—I'll talk a little later about using multi-processing programs on the PC BBSs to let the computer do double duty.

Unless your users are only going to place messages to other local users on your BBS, you have to find a way to deliver messages to those out of your coverage area. In many areas (EASTNET, for example), there is a sophisticated network of forwarding arrangements established to efficiently move mail into and out of the area, as well as handling mail passing through. Any BBS set up in that network that is not coordinated with the other stations can cause major problems for the other stations by dumping mail into the network that the network doesn't know how to deliver. This BBS could also deny its users access to the rest of the network by not participating in coordinated forwarding. Unless you're the only BBS within range of your station, you *must* coordinate mail forwarding with the other BBSs.

Maintain your system.

Keeping a BBS on the air requires a lot of maintenance. Many sysops spend at least an hour every night reading mail, untangling the mail file, removing outdated messages, installing new versions, etc. New versions may crash, which can take two to three hours to fix. Hardware fails, too, and you have to do a certain amount of hardware maintenance. If you don't do this, you won't be able to serve your users properly.

Add something to the information.

Generally a BBS fills up with reasonably good information supplied by users.

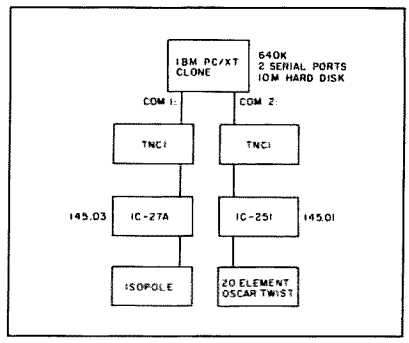


Fig. 2. The BBS system at WB2MNF.

Since you have access to the BBS any time you want it, though, and since you can transfer data faster than anyone accessing it over packet can, it behooves you to add to the information on the BBS. Maybe you're a CompuServe user and can get the *W5YI Report* from HAMNET. Perhaps you can get the useful messages from DRNET, or can post the Keplerian elements for OSCAR. You ought to find some way to add to what your users post.

Be ready to answer questions.

Since the BBS is always there for someone to use, and you obviously know something about packet radio or you couldn't have set it up, don't be surprised if you start getting questions from new users (or old ones) about everything under the sun. Expect your phone to start ringing at least once a week. Expect to see four or five messages a day from users wanting to know about anything at all. Be ready for this and find your own sources for information.

Set a good example.

Whether you like it or not, a BBS takes a high profile in packet activity. It's always on the air and people see it a lot. It is usually the first thing a new user sees. If you're using improper TNC settings (too short a DWAIT, too long a TXDELAY, too many BEACONs, etc.), you're encouraging others to do the same. Make sure that your station is set up properly. It'll help other people get theirs right.

Software Considerations

Any computer system is composed of two parts—the software and the hardware. With most applications, the software comes first in determining the configuration of the system, and the hardware is selected to fit the software. Packet BBSs are no exception.

There are certain factors that you should consider when you select packet BBS software. Packet has some special capabilities that can be utilized to enhance the BBS operation. There are also some things about packet that differ substantially from telephone BBSs, making the latter generally unsuitable for packet use.

First, in packet the caller is identified from the connect message. The BBS knows who you are from the beginning—you don't have to identify yourself. This enhances several

BBS capabilities—message handling, logging, etc. BBSs should use this fact.

Packet radio is by nature a nonsecure medium. Everyone sees everything that is transmitted over the air—there's no such thing as a "private" message. It's useless to use different levels of password-protected access to keep the system secure because packet BBSs generally have only one level of access that's available to anyone who logs on. For this reason, the BBS must be designed to allow almost anyone to connect, but prevent them from doing anything that they shouldn't.

Packet transmissions are virtually error-free because of the AX.25 protocol. Thus, there's no need to add an additional protocol (like XMODEM). In fact, XMODEM doesn't appear to work too well on packet since the time delay between packets tends to time out the XMODEM counters. That part of phone BBSs has no application on packet.

The major difference between phone and packet BBSs is the sharing of the communications medium with other users. On the phone, you have the entire system to yourself, and the BBS can be as verbose as it wants and not bother anyone. On packet, it's different. There are any number of users on the BBS frequency, and a BBS that sprays unnecessary packets out is not very welcome. In particular, menus are a bad idea—they take too much time to transmit, and most users quickly learn the commands anyway. Also, phone BBSs frequently send extra line feeds in between messages to the user, which detract from the throughput on the frequency. In general, then, phone BBSs are not usually suitable for packet use.

What's Available?

There are a number of different BBSs available for packet use. If you look hard enough you can probably find something that will work on almost any computer. I've seen them for the Commodore 64, the TRS-80 Model 100, and the IBM PC. I'm not really familiar with these, so I won't discuss them in any more detail, except to say that if you decide to put something on the air, please make sure that it's appropriate for packet use.

There are two major packet BBS systems that operate in the EASTNET link. Since I'm familiar with them and not with the others, this article will focus on them.

The WØRLI MailBox system was written around 1984 by Hank Oredson WØRLI. It is written in 8080 and Z-80 assembler specifically for the Xerox 820 computer. Until recently, this computer was the optimal computer for the ham/computer hobbyist because he could pick up fairly good boards for between $50 and $75, add on two 8-inch disk drives, and put a power supply on to get a pretty good 64K CP/M computer. The Xerox 820 has two serial communications ports, which makes it ideal for packet applications. It's still a good machine, but the advent of the $700 PC clone is quickly eating into the market.

To take best advantage of the 820, Hank modified its CP/M specifically for the 820 and MailBox. It won't work on any other computer (so don't ask). Hank makes the source code available on disk, though; so if you're a good 8080/Z-80 programmer, you might want to take a crack at making it work on a different computer.

MailBox supports a number of special features for packet use, including: identification of the calling station at logon from the CONNECTED message; notification of waiting messages at logon; categories of messages, including bulletins and private mail; uploads and downloads of files; notification of another station waiting to use MailBox; "talk to the sysop" paging; capture buffers for sysop use when MailBox is down; automatic forwarding of messages to other MailBox systems; monitoring and logging of frequency activity; and many more. I'd guess that there are at least 100 of these systems operating all over the world.

The other system gaining widespread use is the WA7MBL clone of the WØRLI system. Written by Jeff Jacobsen for the IBM PC, this system looks like the WØRLI system to the user. Almost unbelievably, Jeff wrote the program in Turbo Pascal from Hank's 8080 source code without ever having used a WØRLI MailBox! It has a few features that WØRLI doesn't (and vice versa), but the main advantage of the WA7MBL system

TNC PARAMETERS

The parameters used on the TNC are critical to how well the BBS operates. Some parameters, like ABAUD and PARITY, are determined by the BBS hardware and software. Others, like TXDELAY, are a function of the radios. Of interest here are the parameters that control the way the TNC feeds the packets into the network: DWAIT, FRACK, RETRY, PACLEN, and MAXFRAME. These should be fine-tuned to the characteristics of the network. These are TNC-1 parameters. TNC-2 users adjust accordingly.

DWAIT controls the amount of time that the TNC will wait after seeing a clear frequency before it sends a waiting packet. It thus determines the priority of the stations on the frequency. A station with a DWAIT of 2 will always jump ahead of a station with DWAIT of 15. Since a BBS station sending a long file could literally shut down a frequency by using a low DWAIT, it must use a higher one to allow the shorter packets from the keyboard-to-keyboard people to go through. A BBS on a shared frequency should use a DWAIT of about 15 to be sure that the other users have a shot at the frequency. On a dedicated BBS frequency, though, a lower number should be used to increase throughput.

FRACK is the amount of time that the TNC will wait after sending a packet and not receiving an acknowledgment before sending the same packet again. FRACK should be set considering the load on the network. When the network is heavily loaded, an acknowledgment packet may wait at a station for several seconds until the frequency is free. If the sending station has FRACK set too low, it will re-send the same packet even though the receiving station heard it the first time. This creates needless clutter and slows down the transfer of the data. For normal use a FRACK of 4 should be appropriate, while on moderately heavy links a FRACK of 8 or more is better.

RETRY governs the number of times the BBS will repeat a packet before giving up. This is important for a BBS sending long packets, especially those in the opening greeting message. Often a station will connect with a BBS, but won't hear the BBS well enough to hear its packets. If RETRY is set high, the BBS will pump out its three- or four-line greeting message into the ether many more times than necessary. In general, if a station requires more than about five retries to use a BBS, the link isn't good enough and he shouldn't try it. We have our RETRY set to 6.

PACLEN determines the number of characters in the packet. Most TNCs are set to default to a PACLEN of 128 characters, but there are circumstances where a higher or lower setting may be appropriate. If conditions are bad, a shorter packet has a higher probability of making it through, and PACLEN should be reduced, possibly as low as 40. On the other hand, on a clear frequency with local links, PACLEN can be increased up to 256.

MAXFRAME sets the number of frames to be contained in a single transmission. A MAXFRAME of 4 means that four packets are sent at once. Like PACLEN, this parameter is also sensitive to frequency conditions. If conditions are good, using a higher MAXFRAME improves the speed of the data transfer, since more data is being sent in each transmission. On the other hand, if many packets are not getting through, a higher MAXFRAME means that more data is being wasted each time and that a better throughput could be achieved by reducing MAXFRAME.

Here are some recommended settings for these parameters:

- For a frequency shared with other users and BBS stations with moderate load: DWAIT 15, FRACK 6, RETRY 6, PACLEN 128, MAXFRAME 3.
- For a frequency heavily loaded with users, BBSs, and digipeaters: DWAIT 15, FRACK 10, RETRY 8, PACLEN 80, MAXFRAME 1.
- For a dedicated BBS frequency with no keyboard-to-keyboard users and strong links: DWAIT 2, FRACK 4, RETRY 4, PACLEN 256, MAXFRAME 6.

You should review the performance of your BBS and its impact on the frequency at frequent intervals, and adjust these parameters as appropriate.

is that it runs on the PC. This means that you have 360K floppy disks instead of the 241K disks for the 820. You can also put on a hard disk (I have a 10-megabyte hard disk on my system) and have almost unlimited storage. Jeff hasn't released the source code for the system (so don't ask) because it's still being tested. By the time this article appears, though, it may be available for general use.

There is also some basic documentation available for these systems, written by WB2MNF. The manual for the WØRLI system is fairly up-to-date and somewhat long (about 75 pages). The WA7MBL manual is a little shorter and less complete—hopefully it will grow over the summer when WB2MNF has more chance to work on it.

The disks and manuals are being handled by Wes Morris K7PYK at 7422 E. McKinley Street, Scottsdale AZ 85257; (602)-945-6079 or 946-8356. Wes will send you the disks and documentation for either the WA7MBL or WØRLI system for postage costs. Contact him for current prices.

Software Support

An important factor in setting up a BBS system is support from people who know what they are doing. One rule should be followed: *Don't call Jeff or Hank with questions!* With hundreds of installations springing up over the country, neither of these guys has the time to help every sysop get going. It's also best for the network to let Jeff and Hank spend their time writing code for the BBS systems, not talking on the phone.

So who do you call? The best place to start is your local sysop. He's obviously conquered the system or he wouldn't be on the air. Drop him a note on the BBS and tell him what you've decided and ask for help.

If there's no BBS in your area and nobody knows anything about them, you might want to check out the HAMNET SIG on CompuServe. There's an active packet group there and a special section for BBS sysops. A lot of active sysops hang out there and you can get answers quite quickly.

Equipment

As in any type of computer application, the availability of software determines the hardware to use. As I just described, there are two major types of packet BBSs in wide use—one running on an IBM PC or clone, the other on a Xerox 820. It doesn't take a whole lot of deductive ability to see that if you want to use either of these programs, you'll have to use one of these computers.

Xerox 820's were available in quantity about a year ago, but good ones are getting few and far between. A number of BBS operators who ran them and switched to PCs may have them assembled and for sale, so check around on the boards.

The PC clone is getting cheaper every day. Systems are offered at hamfests and computerfests for less than $800, complete with disk drive (or two), keyboard, monitor, and a very IBM-looking case. Check these things out and be sure that you know what you're getting. Although the WA7MBL BBS will run in 256K, many sysops use DoubleDos or some other multi-processing program to use the computer for something else while the BBS is running, and this will require much more memory.

You also might want to look into using a hard disk. Prices for these are dropping quickly, to the extent that a 10-megabyte hard drive will cost only about $125 more than a floppy drive. It's definitely the way to go if you can afford it.

A TNC is obviously required to set up a BBS system. With the plethora of TNCs springing up, some discretion should be exercised in deciding which one you should use.

The TNC you choose has to be supported by the BBS software. The WØRLI and WA7MBL systems support the TAPR command set, used by the TNC-1, the TNC-2, and their clones. If you use one of these TNCs, you're pretty safe. If you want to use something else, you should check with a sysop using the TNC you're considering to be sure that it works OK with the software.

The other consideration is how many TNCs you want to put up. Both BBS packages support two TNCs and rigs, allowing the BBS to cover two different frequencies, bands, baud rates, etc. This allows the WB2MNF BBS to access EASTNET on its primary frequency of 145.01, while also using 145.03 for local stations that only want to work the BBS. It also allows KC2TN to "gateway" messages from 2 meters to a group of BBS stations operating on 20 meters for long-haul traffic forwarding, and lets WB2RVX keep a port on 145.01 while maintaining capabilities for 9600-baud forwarding on 220 MHz when that becomes a reality.

The problem generally is that the primary frequency, which is where you want to do your forwarding, is generally too busy to support another BBS. You have to decide how you're going to maintain contact with the forwarding network without clobbering the stations on that frequency with "yet another BBS." Two TNCs and rigs may be the way around this.

Message Forwarding

One of the most useful features of a BBS is the ability to handle personal messages between packet users in the network. By "personal messages," I mean messages specifically addressed to an individual from another station. Stations logging into a BBS can be greeted by name and told of messages waiting for them. Messages are addressed to a specific callsign or to a designated name like ALL or NTS.

Packet radio jumped up a notch when WØRLI released the message-forwarding capability of his MailBox system. This allows the sysop to develop a forwarding file that lists the paths to other BBS stations and the calls of stations whose mail should be forwarded to that station. When a station leaves a message addressed to a station at a distant BBS, the local BBS will, at its appointed time, go off-line and connect with the distant BBS and send the message there.

With good coordination of sysops in a network, messages can be daisy-chained over long stretches in a remarkably short period of time, being relayed by a number of BBS stations along the way. This generally occurs overnight (except on HF), and it all happens without operator intervention. A message may show up from the south on a BBS, which will promptly relay it to the next station to the north—all without the sysop doing anything. The EASTNET network has reliable message forwarding from Canada down through Virginia and west to Pittsburgh on VHF.

Considerations

As a mail server, you should know about certain requirements on the BBS system. Some of these are:

Maintenance—If you want to handle a lot of mail, be prepared for more than the usual amount of maintenance. Mail files have to be compacted, old messages must be removed, and occasionally messages have to be recovered from system crashes.

Forwarding—You also have to coordinate mail forwarding with the other sysops in the network. It's important to know how to get mail to other BBSs, and it takes a coordinated effort to do it. If you expect to handle mail and can reach another BBS, get in contact with the sysop and work out the forwarding times and stations list with him.

Disk space—Mail files take a lot of space on a BBS. When I was running the WØRLI software on the Xerox, my whole B drive was mail files. I couldn't put anything else on there. This limited my ability to handle files—I just didn't have room to put up the *Gateway* newsletter every two weeks. Keep this in mind when you're planning your system. (*Gateway* is the bi-weekly packet-radio newsletter published by the ARRL. Excerpts suitable for transmission on the amateur bands can be found on many BBS systems. The full paper issue is available by subscription.)

File Transfers

The WØRLI and WA7MBL BBS systems will handle files as well as messages. Files may contain any type of information—text, programs, data, etc. Some of the files that I have on my system are issues of *Gateway*, tracking programs for the TRS-80 Model 100, minutes of the local packet organization, programs for the PC, news items downloaded from CompuServe, the text of relevant FCC issuances, a current set of Keplerian elements for ham-radio satellites, and descriptions of how to use the BBS. These can be loaded onto the BBS by the sysop, as well as by users.

There are a number of sources for these files. Some are created by the sysop or from messages sent by others. Some, like the ARRL bulletins, come from a different amateur-radio medium. Others may come from land-line BBSs, from commercial timesharing services like CompuServe's HAMNET special interest group, from DRNET or USENET, or from BBS users who have access to these services. With good coordination among sysops, many can be forwarded from BBS to BBS.

The sysop has a responsibility to try to get useful information to his users. Many sysops spend their own money on commercial services to get information that isn't available elsewhere. Whether you do this or not is up to you, but if you let the files on your BBS stagnate, you're not adding as much as you could to the packet network.

Don't overlook the opportunity for your users to contribute files to the packet network. Many packet users have access to these types of services also. If you can enlist the aid of a few individuals to help you keep your files up-to-date, it will save you a lot of time and make your BBS more useful to the local packet community.

Programs

One good use of packet radio that hasn't been explored a lot is the transfer of computer programs. If your users include a number of computer hobbyists, this might be an interesting area for you. Programs can be either ASCII text files (Basic programs or other source-code files) or, with a little adaptation on both ends, binary files.

First, though, you have to consider a few things. What kind of computers are you going to serve? What do most of your potential users have? Most will probably have a different type of computer than you do, which means that you may not be able to run the programs that are going to be transferred through your BBS. That shouldn't be too much of a problem, but it might be a little disconcerting to you.

Commodore 64 computers use a strange version of ASCII called PETASCII. This means that you can't just read an ASCII Basic into a C-64—before you send the file, you have to convert it from PETASCII to ASCII, then convert it on the other end back into PETASCII.

IBM PCs and clones use Basic programs as straight ASCII files, so they can be transferred with little additional work. If you want to transfer COM or EXE files, though, you have to convert them to hexadecimal format before you transfer them to the BBS. This is because the BBS programs described in this article operate in CONVERSE mode, which doesn't pass all binary characters, rather than in TRANSPARENT mode, which does.

There are several programs that will perform this conversion—the one we use at WB2MNF is called HC.COM and came from CompuServe. There's also a Basic program called MAKEHC.BAS, which will create the file HC.COM. The advantage to MAKEHC.BAS is that it's ASCII and can be downloaded directly by any user, who then runs it to create HC.COM. Once he has HC.COM, he can convert back to COM or EXE the files that you had to convert to hexadecimal on the BBS. HC.COM goes both ways—from COM or EXE to hexadecimal and back.

Many computers use Basic as a sort of operating system. These computers may or may not accept Basic programs in ASCII format. Frequently Basic is "tokenized"—each Basic command or keyword is held as a specific symbol rather than the text of that word. Thus, instead of holding the PRINT command as the letters P-R-I-N-T, Basic would use a single 8-bit symbol to represent the PRINT command. The TRS-80 Model 100 uses this approach, as do a number of other computers.

Many of these computers provide for converting tokenized Basic to ASCII text, and this would be the easiest way to transfer these files through the BBS systems. Failing this, they would have to be converted to hexadecimal files as described above.

How Big Can Programs Be?

Another consideration relating to transfer of program files is the capacity of the network to pass large files. If your BBS operates on a dedicated BBS frequency, you can probably pass quite large files. On the other hand, if you share a frequency with other BBSs and users, your capacity for large file transfers is quite limited. On the 145.01 general frequency used in our area, the maximum file size that can generally be passed without losing the connection is about 15,000 bytes. On 145.03, which is a dedicated BBS frequency, we have transferred files in excess of 60,000 bytes with no problems. Since making a hexadecimal file out of a COM file will double its size, and since many interesting COM files are larger than 20,000 bytes, you may be limited in your ability to transfer anything useful by the capacity of the network in your area.

One side note: The problem with passing binary files occurs only with BBSs that can't operate in TRANSPARENT mode. If you're transferring files between two TNCs and can operate that way, there's nothing stopping you from transferring binary data.

Getting Set Up

Once you've worked out all the nontechnical aspects of getting the BBS operational (you know what frequency you're going on, how you're going to forward mail, where you're going to get file data, etc.), it's time to start hooking things together. The hookup between the radios and the TNCs isn't too complicated, and I'll assume that you've been able to do that already. The TNC connects to the serial port of the computer with an RS-232 cable similar to the one used to hook up a modem. You have to be sure that you have all of the pins of the cable connected from one connector to the other since various versions of both systems use the handshaking lines of the cables to tell the computer and the TNC when the other is ready.

You also have to configure some files for the BBS. Both systems have configuration files, which allow you to customize the boards to a large degree. Generally you can alter anything the BBS says to a user—the greeting message, prompts, error messages, etc. Edit the configuration files, read the explanation on the lines, and change the information appropriately.

The forwarding file also has to be set up. This file is called FWD.TNC on both systems and determines which messages get forwarded to which BBS stations. It also determines which hours you will forward and which you won't. This allows you to avoid forwarding mail during prime times when the frequencies are in heavy use.

Forwarding files specify where messages addressed to certain stations should go. The format of a forwarding file is:

```
FAsseeC bbs VIA digi1, digi2
station1
station2
etc.
*** EOF
```

where *ss* is the starting hour for forwarding, *ee* is the ending hour for forwarding, *bbs* is the call of the BBS to which you wish to forward mail, *digi1* and *digi2* (and any other digipeaters) are the digipeaters through which you have to digipeat to get to the BBS, and *station1*, *station2*, *etc.* are the stations whose mail should be forwarded to the BBS.

Stations that originate messages specify that mail should be forwarded to a distant BBS by following the call of the addressee with an @ sign and the call of the distant BBS. Thus, to send mail to WB2AFM, who receives his mail at the W1AW BBS, the command is: S WB2AFM @ W1AW. This presumes that the BBS at which the message was originated has W1AW in its forwarding file.

Sometimes your BBS can't forward to the destination BBS directly and must send messages to an intermediate BBS, which will then take care of forwarding it on down the line. This happens in EASTNET quite frequently. If a message is originated on the W3IWI BBS in Maryland and is addressed to a station using the W1AW BBS, W3IWI doesn't attempt to forward it directly to W1AW. Instead it will send it to WB2RVX in southern New Jersey, which will forward it to WA2SNA-2 in northern New Jersey, which may forward it to AI2Q on Long Island, New York, which may deliver it at W1AW. This all happens automatically without the manual intervention of the sysop, and generally occurs overnight. As you can imagine, though, it requires a lot of coordination among the sysops to be sure that the messages get going in the right direction.

You'll have to get together with the sysops in your area to decide on forwarding times. Each station in a network is assigned a time to forward messages to the other stations. Times must be coordinated so that two stations don't try to forward to each other at the same time.

A Real Live BBS System

It might be useful to look at an operating BBS station to see how things might be organized. The BBS at WB2MNF has been operating since November of 1984, first on a Xerox 820 running the W0RLI program and recently using a PC/XT clone dedicated to the BBS with the WA7MBL code. We handled over 7,000 messages on the 820 and are up to about message 1,500 on the PC.

The PC has a 10-megabyte hard disk, which provides for plenty of storage space. About 5 megabytes is filled with packet files,

with the rest used for other things. The disk is divided into "directories," which separate the files into logical groups. I have directories for AMSAT, ARES, GATEWAY, MODEL100, IBMPC, and several other areas of interest.

I use the DoubleDos program available from SoftLogic, which lets me run the BBS program on one "side" and still have access to the computer on the other. I can switch between them at will. Others who "share" their computers with the BBS may use DoubleDos, DesQview (from Quarterdeck Software), or some other multi-tasking program to use the computer for something else while the BBS is running.

The WA7MBL program lets you operate the BBS with two different TNCs and radios on two different frequencies. The primary frequency in our area is 145.01; it's crowded almost constantly, so I run one port on 145.01 and the other on 145.03. When one is in use the other is unavailable, but it does provide access for distant users on .01 while letting more local users enjoy less QRM on .03. I have two TAPR TNC-1s connected to an IC-27A and an Isopole on .03, and an IC-251 and OSCAR twist on .01. Although not optimal, this lets me cover most of the local service area.

Personal Message System

One message-handling system that has received surprisingly little attention is the Personal Message System (PMS). A PMS is a BBS system that handles data only for its sysop. At first glance this may seem a bit selfish, but under careful consideration it makes a lot of sense.

A PMS allows the sysop to compose a message to another station without having to be connected to a BBS. The message stays on the PMS and can be read by the addressee if he happens to log in. If not, the PMS forwards the message to the addressee (if he also has a PMS) or to the addressee's BBS. This can happen overnight or during other periods of light use of the frequency. It also makes things a lot easier for the user—at night you type in all of your mail, and by the next morning it's been delivered to the destinations and you have new mail that was forwarded to you. It's the difference between having mail delivered to your front door or having to go to the post office.

Any of the BBS software mentioned earlier can be used as a PMS. There are also default parameters in the forwarding files that let you say, in essence, "Send any mail not addressed to me to the W1ABC BBS." This lets you forward all outgoing mail to your local BBS, which will then distribute it into the network.

If you don't happen to have a PC or Xerox 820 to use for a PMS, but would like to try a receive-only system, W3IWI demonstrated that the TNC-2 and clones can be set up to operate that way. The WØRLI and WA7MBL BBS systems look for the following sequence of responses when connected to a BBS to which they are forwarding: the > character at the end of the prompt line, two lines ending with a <cr> character, and another > character at the end of the next prompt line.

This sequence can be programmed into the CTEXT of the TNC-2 and should be repeated to allow several messages to be forwarded during one connect. The computer connected to the TNC should have a "capture buffer" or "save to disk" enabled to record the forwarded messages. Finally, the MONITOR function on the TNC should be turned off to keep from filling the buffer with every packet that comes through.

Packet users wanting to use this system should notify their local sysop that they want to accept forwarding. The sysop will then add their station to the forwarding files of the BBS, and any messages arriving at the BBS should be forwarded to them at the next forwarding time.

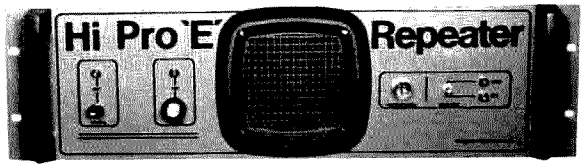
Conclusions

If being a sysop doesn't sound like the picnic that you thought it might, then you haven't missed the point of this article. Packet-radio bulletin-board systems are an important addition to local packet activity and will form an important part of the ever-expanding packet network. There's a lot to making them work effectively, though, and sysops should be aware of the considerations surrounding their operation. Even if you don't want to be a sysop, knowing what a sysop has to go through can help make you a better user. ■

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WRITE OR CALL FOR OUR COMPLETE CATALOG

Harold Price NK6K
Tak Okamoto JA2PKI
Hanspeter Kuhlen DK1YQ
Peter Guelzow DB2OS
Donald Moe DJØHC/KE6MN

Birds 'N' Bauds

Satellites are going digital in a big way—five international experts combine to define our place in space.

The packet-radio revolution has slipped the surly bonds of Earth and is headed for orbit. Two amateur spacecraft slated for launch in 1986 have dedicated general-access digital links. A satellite already in orbit carries a digital store-and-forward communications experiment. Digital communications figures into the plans of several satellites currently on the drawing boards. This article will discuss digital activity on the high frontier, and will help you prepare to use the new digital fleet as it becomes available.

The first section of this article (written by Harold Price NK6K) supplies a bit of background and discusses the digital facilities of UoSAT-OSCAR-9 and -11. The second section (written by Tak Okamoto JA2PKI) describes the mailbox on the JAS-1 spacecraft, scheduled for launch on August 1st of this year. The third section (written by Hanspeter Kuhlen DK1YQ, RUDAK Experiment Project Leader; Peter Guelzow DB2OS, Deputy RUDAK Project Leader; and Donald Moe DJØHC/KE6MN, Member of RUDAK Group) describes the RUDAK packet transponder, which is slated to be a part of Phase-3C, scheduled for launch in October.

This article is not intended to be a general satellite tutorial, rather it is a survey of the interesting things going on digitally, to entice you into finding out more. See reference one for an excellent text on amateur satellites for both the beginning and advanced amateur.

INTRODUCTION

Microprocessors and digital communications have played a part in all of the recent amateur spacecraft. They have usually been dedicated to telemetry and command functions, however, as well as on-board control. The AMSAT-OSCAR 10 (AO-10) spacecraft is completely dependent on its on-board computer for control. The UoSAT-OSCAR-9 (Uo-9) and Uo-11 spacecraft can be controlled directly from the ground, but each carries several microprocessors that carry out autonomous spacecraft control under normal conditions. Although these and previous spacecraft use digital data to send telemetry and receive commands, the spacecraft launched in 1986 will be the first to carry digital equipment as part of the two-way communications payload accessible to the amateur community at large.

Spacecraft can be used to enhance digital communications in several ways. The first is as a one-way digital beacon. Uo-9 and Uo-11 transmit informational bulletins as well as spacecraft telemetry. The data format is easy to decode, and receive-only ground stations are easy to build.

One two-way application is simply to use a spacecraft as an analog repeater. AO-10 serves in this capacity now. It receives rf on one band and simultaneously retransmits it on another band, with no processing of the signal. Any mode can be repeated by the satellite, including SSB, RTTY, SSTV, and packet. Power-inefficient modes such as FM, while they are repeated like any other signal, are not permitted on AO-10. Packet can be sent through AO-10; in that respect, AO-10 acts like any normal voice repeater—any re-



Photo A. Dr. Martin Sweeting G3YJO, UoSAT Project Director, listens to the Uo-9 spacecraft with a hand-held 2-meter FM radio. The antenna array in the background is used for commanding and data collection.

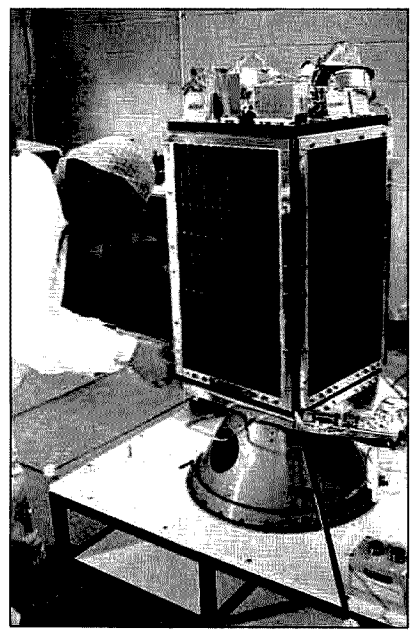


Photo B. The UoSAT-OSCAR-11 spacecraft. Ian Ferebee G6BTU is attaching a solar array panel.

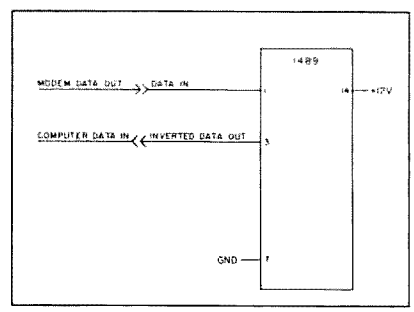


Fig. 1. Crude RS-232 inversion circuit for reading Uo-11 data.

peater on a mountain 33,000 km high, that is.

A second two-way use of a spacecraft is as a digipeater. There are several advantages to this style over the AO-10 method where packet is concerned. First, packets are checked for accuracy in orbit before being repeated. This saves time otherwise wasted by downlinking a damaged packet. Second, each packet starts "fresh" from the orbiting digipeater. Since it is regenerated, the repeated packet does not already suffer from the effects of getting to the spacecraft (free-space loss, transponder loss, etc.); it need only make it from space to the ground.

The best space-based digipeater is one that is visible for long periods of time and covers a lot of ground. The RUDAK module on the Phase-3C spacecraft will serve in this function. Phase-3C will be visible for as long as nine hours at a time, and can digipeat packets to more than 1/3 of the Earth's surface for a large portion of that time.

A third two-way use of a spacecraft is as a mailbox, which stores information for later retrieval. A store-and-forward satellite, as this class is called, can deliver messages on a worldwide basis using only a single satellite. A satellite in the proper orbit could continually gather and deliver messages as it moves over the globe. A low-orbit satellite is well-suited for this task since it makes many passes overhead each day. Such a satellite is not well-suited for use as a digipeater, though, because only small (compared to Phase-3 orbits) areas can see the satellite at one time. The JAS-1 spacecraft will serve in a mailbox role; Uo-11 is already performing this function on a limited basis.

UoSAT Spacecraft

We'll start our discussion of specific spacecraft with two that are in orbit now: Uo-9 and Uo-11.

Uo-9

The UoSAT-OSCAR-9 spacecraft was the first to offer high-speed digital telemetry from orbit. Previous spacecraft had sent telemetry by using Morse code, and some could even receive messages from ground command stations for playback on the Morse beacon. Uo-9 runs standard ASCII data at 1200 baud, and can thus send many thousands of characters in a pass. Uo-9 carries a regular bulletin service, with bulletin sizes in the 5-to-10K range. The bulletins carry information about amateur satellites, including operating schedules and orbit predictions, and are transmitted in plain text.

Uo-9 transmits using FM at 145.825 MHz. It can be heard on a hand-held from out in your front yard (see Photo A). To recover data, however, you will probably need a beam antenna. For best results, you will also need to know when to listen. A variety of orbit-prediction programs are available for nearly all makes of computers, including TS-1000, VIC-20, C-64, TRS-80, Apple, and IBM PC. Contact AMSAT for information (PO Box 27, Washington DC 20044).

Any Bell 202 standard 1200-baud modem can be used to read the Uo-9 data stream. The Bell 202 standard uses 1200-Hz and 2200-Hz tones. Surplus modems are available at larger computer swap meets in the $25-to-$90 range. Most 1200-baud modems used with personal computers are *not* suitable, however. They use the Bell 212 standard, which is a horse of a different color. The 1986 ARRL *Handbook* describes a simple modem that can be built from scratch. The bulletins are transmitted in clear text, and are sent at regular intervals. Telemetry and other data are alternated with the bulletins. For stations currently beyond the reach of the VHF and HF packet network, the Uo-9 bulletins present information weeks or months before the paper periodicals.

Uo-9 was launched in October, 1981, and carries a number of experiments. Uo-9 is similar in appearance to its sister craft Uo-11, pictured in Photo B.

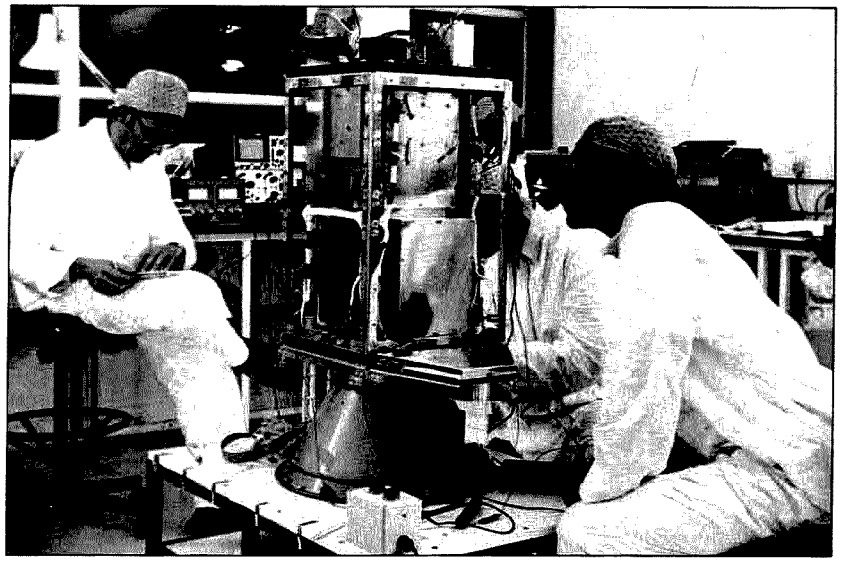


Photo C. Uo-11 under construction at the University of Surrey.

Uo-11

Uo-9 offers a one-way bulletin service. The main spacecraft computer's memory is used to contain the message text, and the main computer is used to transmit the bulletins. Because of this, only the primary control station is able to upload bulletins. Uo-11, on the other hand, has a separate processor with its own data storage. This permits experimentation with an orbiting store-and-forward mailbox with reduced hazard to the spacecraft itself. A store-and-forward capacity means that messages are uploaded to the spacecraft and held there until a second ground station commands their retrieval.

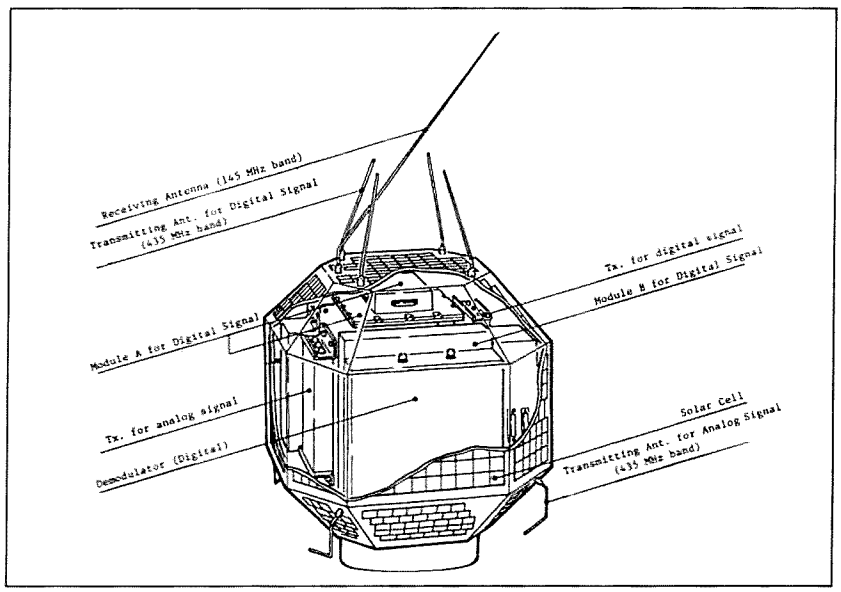


Fig. 2. JAS-1, showing internal packaging and antennas.

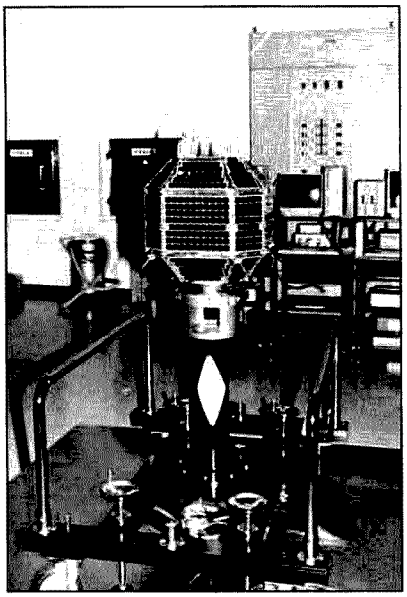


Photo D. JAS-1.

The Digital Communications Experiment (DCE) provides this service. The DCE is a self-contained microcomputer carried as one of several experiment modules on board Uo-11. It was designed and built by amateurs and others in Canada and the United States. The DCE contains 126K of memory for program and message storage. In the current software configuration, 96K is available for messages. The DCE contains an NSC-800 microprocessor, which behaves like a CMOS Z-80.

Although the DCE is a separate facility, it still shares the main downlink beacons and command uplink frequencies. This limits the number of stations that can transmit messages directly to Uo-11. Therefore, the Uo-11 DCE is best suited for access via gateway stations. A Uo-11 gateway station collects traffic from local or regional terrestrial packet systems and forwards it to the satellite. It also retrieves messages destined for its area and distributes them. In this manner, a large number of amateurs can take advantage of the DCE even though only a few can transmit to it directly.

The DCE is also being used for large file transfers. These files usually contain technical papers, bulletins, and newsletters. In the past few months, nearly one million characters have been passed between ground station NK6K in Los Angeles and ground station G0/K8KA at the University of Surrey. These two persons collaborated on a paper, transferring a 20K file six times across the Atlantic in a few days.[2] There were three active gateway stations in May of 1986; several more are planned for the near future. Many messages have been relayed to and from the ground-based packet network, and the techniques learned and the software developed will be directly applicable to JAS-1 gateways. As discussed later, JAS-I will be available to anyone, and a large number of direct and gateway users are anticipated.

Uo-11 also carries bulletins similar to those on Uo-9. It transmits ASCII data with the same modem tones as Uo-9, but the sense of the mark and space tones is reversed—Uo-11 data is "upside down"; in the U.K., the BBC microcomputer considers this to be "right-side up." To decode Uo-11 data with whatever you have to decode Uo-9 data will require inverting the data stream. The possibly least-elegant solution to this problem is presented in Fig. 1. Its advantage is that it will work in-line between the modem serial output and the computer's serial input. Its disadvantage is that it works only with computers that can deal with RS-232 data swinging between 0 and +12 volts. My IBM PC has no problem with these levels, and neither does a vintage S-100 CP/M system.

Uo-11 was launched in March, 1984, from California. It transmits on the same frequency as does Uo-9: 145.825 MHz.

JAPAN AMATEUR SATELLITE-1 (JAS-1)

(A note to our Japanese readers—Tak Okamoto JA2PKI/N6MBM, a temporary resident of southern California, returned to Japan shortly after this collaborative article was begun. I've expanded on one or two items. If something below is not said in the Japanese way, my apologies. It's not Tak's fault; he did his best not to get tainted by California while he was here. I'm sure any behavioral aberrations are temporary and will soon wear off now that he has returned home.—NK6K)

JAS-1 is an amateur radio satellite, promoted by JARL (the Japanese national radio society) as a joint venture with NASDA (the national space agency). NEC (a large electronics company) constructed the "system" units (space frame, power supply, etc.), while JAMSAT (the national amateur satellite group), with its selected volunteer JAS-1 project team, designed and built the "mission" units (transponders, telemetry/command, and housekeeping microcomputer) and ground support systems.

JAS-1 has been completed and has passed all the necessary tests. It is in a clean room waiting for the launch, currently scheduled for August, 1986.

JAS-1 Mission Objectives

JAS-1, like Uo-11 and Phase-3C, is a shared mission; packet radio is not its only task. Since this is the first craft in its series, we'll take a broad look at the spacecraft and its mission before delving into the packet specifics. The objectives of JAS-1 follow:

- To provide reliable worldwide amateur radio communications.
- To enable radio amateurs to study tracking and command techniques.
- To offer an in-space "proving ground" for radio-amateur-developed and -built transponders and subsystems.
- To provide NASDA an opportunity to carry out a "multi-payload" launch using their

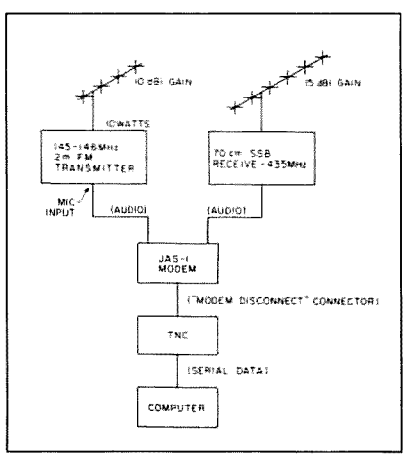


Fig. 3. JAS-1 digital ground station.

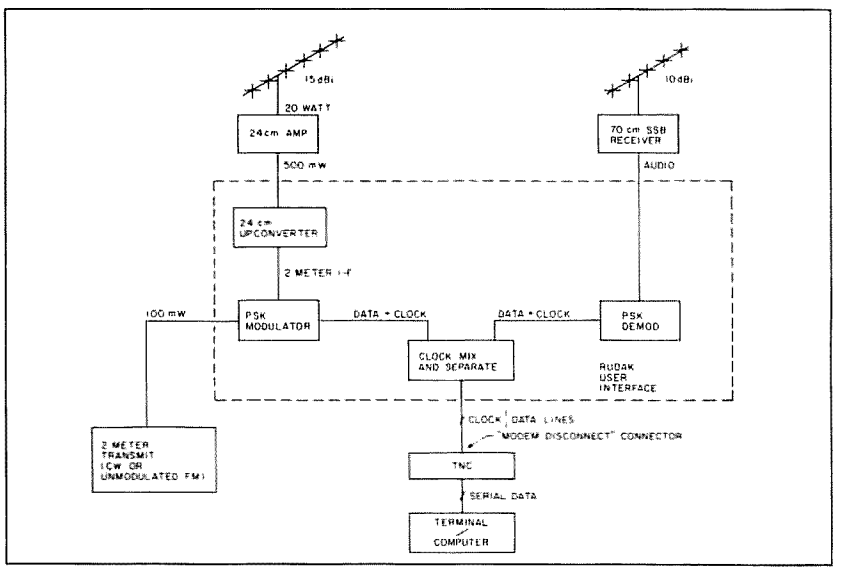


Fig. 4. RUDAK ground station.

new "H-1" launcher. (NASDA has never engaged in a multi-payload launch; thus, the JAS-1 project will offer NASDA an excellent opportunity by providing them with an active payload having its own telemetry beacon and transponder for ranging.)

The spacecraft takes the form of a 26-facet polyhedron, which measures 400 mm x 400 mm x 470 mm and weighs 50 kilograms (see Photo D and Fig. 2). JAS-1 will be launched into a circular orbit by a two-stage rocket. The orbit will be low, about 1500 km, but higher than the Uo-11 orbit of 800 km. JAS-1 will have an inclination of 50 degrees, which will result in a different cycle of passes from most previous low-orbit amateur satellites. Since most tracking of amateur satellites is done with computers, this will pose no problem. JAS-1 will take 120 minutes to circle the Earth, and will be visible for about 20 minutes per pass. There will be approximately eight passes per day.

JAS-1 carries two separate mode-J (2 meter up, 70 cm down) transponders. One is a linear transponder, and the other is a digital "store-and-forward" transponder, mainly for non-real-time communication between stations located in different time zones.

The reasons for selecting mode J for this first Japanese amateur radio communications satellite are:

a) It is becoming increasingly difficult to use 145 MHz for a satellite downlink because of man-made electrical noise and other interference. This is especially true in Japan where the 2-meter band is crowded with simplex activity.

b) The planners of JAS-1 wanted to provide a successor to AMSAT OSCAR-8's mode J, which was originally developed by JAMSAT's engineering team back in 1976.

c) 435 MHz is much quieter than 145 MHz as a downlink band; it is comparatively free from man-made noise and sky-temperature effects.

Communications Parameters

The standard analog linear transponder is called mode JA. The passband will be 100 kHz wide. The transponder will have an output of 1 Watt PEP. Ground stations will need an uplink power of 100 Watts eirp. The sidebands will be reversed—i.e., the uplink is LSB, the downlink is USB. There will be a 100-mW CW beacon switchable to PSK when needed. See Table 1 for details.

The digital transponder is called mode JD. There will be four 145-MHz-band input channels using Manchester-coded FM for the uplink. Ground stations will need a transmit power of 100 Watts eirp. There will be one downlink channel in the 435-MHz band using PSK; the output will be 1 Watt rms. See Table 2 for details.

The data format is HDLC. The protocol is AX.25 level 2 version 2. The data-transfer rate is 1200 bps for both uplink and downlink.

The reasons for not using Bell 202 type FSK modulation are:

a) To reduce the parts count on board JAS-1. Using Manchester-coded FM for uplink reduces JAS-1's on-board decoder chip count by 16.

b) To improve the downlink margins. Due to JAS-1's tight power budget, only 1 Watt is generated by the downlink transmitter. A more efficient modulation scheme like PSK is required.

JAS-1 will be a store-and-forward system, but not a real-time digipeater. Digipeating is not an effective use of a low-orbit satellite such as JAS-1, which has a limited communication footprint and visibility time.

JAS-1 has four uplink channels and one downlink channel. This is because of the difference in channel efficiency between uplink and downlink. An uplink channel is shared by several ground users. Since the ground users can't hear each other and are listening to the downlink channel anyway, the uplinks are subject to packet collisions. This scheme is called "Pure ALOHA," and is known to have a theoretical maximum channel throughput of 18.4%. The JAS-1 downlink is much more efficient, since only JAS-1 transmits there. To balance capacity, as well as add redundancy, four uplink channels are used.

The combined uplink efficiency is then 4 x 18.4%, or 73.6%. The remaining downlink time is used for general messages and telemetry data.

JAS-1 will accept a connect from only one station at a time with the software scheduled for initial use. Multiple connections will be supported in subsequent software updates. General packet operation is scheduled to begin in November of 1986.

Spacecraft Digital Hardware

The microprocessor is a MIL-STD-883B screened NSC-800 running with a 1.6-MHz clock. This is the only processor on board. It

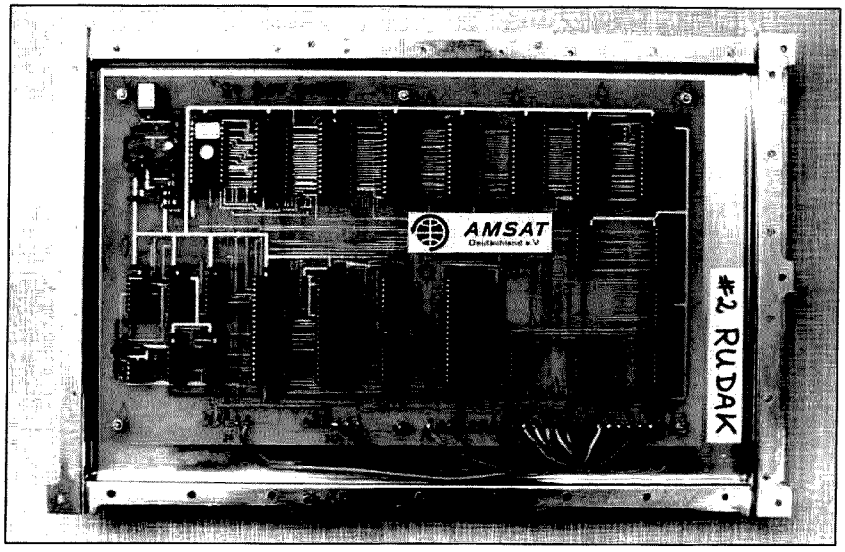


Photo E. RUDAK engineering prototype #2.

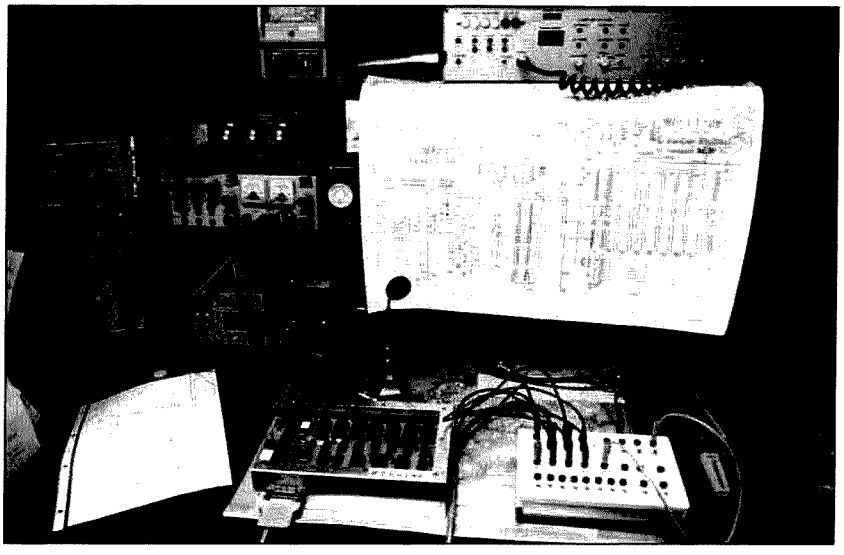


Photo F. RUDAK wire-wrap prototype.

controls the digital transponder and also acts as an IHU (Integrated Housekeeping Unit).

The on-board memory has a 1.5-megabyte physical storage capacity and uses 48 chips of NMOS 256K DRAMs. A hardware-based error-detection/correction circuit is incorporated to protect the entire 1.5 megabytes and provide a 1-megabyte error-free memory area. The system program occupies some 32K; the rest is used for message storage.

The memory unit is physically divided into four identical 256K memory cards, any one of which can be assigned as the system area. Up to three cards can be turned off. This design provides system redundancy and allows command stations to control power consumption without a total loss of service.

JAS-1 has five hardware HDLC controllers. Four of them are for the uplink channels and one is for the downlink channel. In total, these controllers consist of some 140 CMOS MSIs, yet their power consumption is less than that of a single NMOS LSI HDLC controller like WD-1933.

JAS-1 does not have any ROM but has a simple hardware boot-strap circuit instead. This design is to increase system flexibility and reliability.

Uplink passband:	145.90 MHz–146.00 MHz (LSB)
Downlink passband:	435.80 MHz–435.90 MHz (USB)
Beacon frequency:	435.795 MHz
Translate frequency:	581.80 MHz
Transponder output:	1 Watt PEP
Required uplink power:	100 Watts eirp

Table 1. Mode JA parameters.



Photo G. DL2MDL, DB2OS, and DK1YQ performing digital link testing on RUDAK using four user stations.

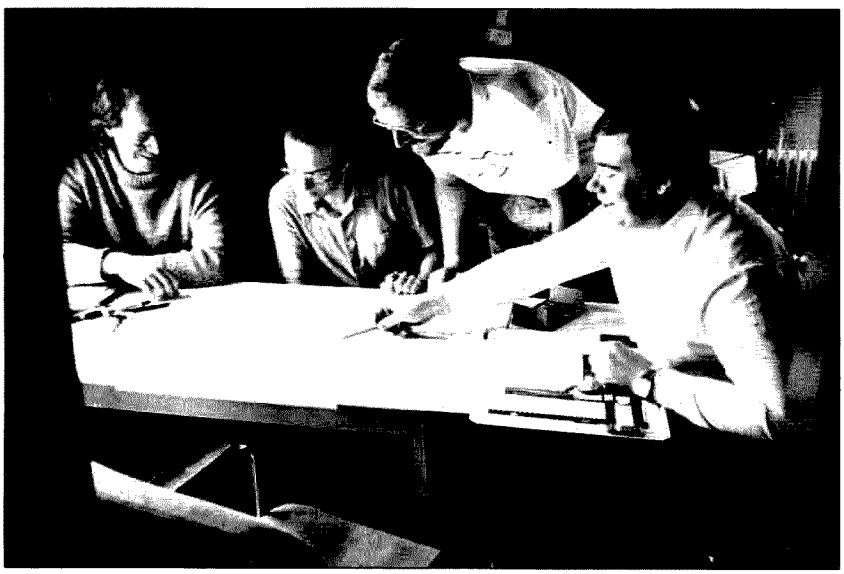


Photo H. DL2MDL, DG2CV, DK1YQ, and DB2OS discuss final changes necessary in the processor circuit.

Ground Stations

The ground-station setup that was used for AMSAT OSCAR-8 mode J can be used for JAS-1 mode JA. A station with a 10-Watt 2m SSB transmitter, a 10-dBi beam for uplink, and a 70-cm receiver with low noise figure with a 15-dBi beam for downlink should be adequate for the job.

To use the JD transponder, FM mode is required for the 2m transmitter. Antennas and power levels are the same as for the mode-JA transponder. Since JAS-1 uses the standard AX.25 protocol and 1200-bps data rate, ground stations will be able to use a TAPR-style TNC, a 2m FM transmitter, and a 70-cm receiver without modification. A mode-JD station is shown in Fig. 3.

The JAS-1 modem, a special interface board, will be made available containing the Manchester modulator and an audio PSK demodulator to allow connection to the "modem disconnect" connector of TAPR TNC-1- and TNC-2-style TNCs. TNCs that don't have a provision for an external modem, such as the Kantronics Packet Communicator, will not be suitable for use with JAS-1. The modem connects to the audio input and PTT of the 2m FM transmitter and to the audio output and frequency control (option) of a 70-cm SSB receiver. JARL is working with TAPR to produce JAS-1 modem kits.

Although JAS-1 will be available for direct access by any amateur, non-satellite-equipped users can still take advantage of its message transfer facilities by the use of JAS-1 gateways. Gateway stations will be connected to local and regional packet networks as well as to JAS-1. JAS-1 can then be used as a relay between gateway stations and, therefore, between amateurs using the gateways to pass traffic.

RUDAK

In October of 1986, another Phase-3 satellite will be carried by an ARIANE IV launcher from the European space center (CSG) in Kourou into its elliptical orbit. A new type of amateur radio transponder will then come into service for the first time—RUDAK.

What Is RUDAK?

Basically, RUDAK is a freely programmable general-purpose computer with 56K RAM. A ROM operating system (ROS) provides general initialization after power-on.

Similar to a TNC board for packet radio, it will be programmed to provide a "TNC in the sky." Two links—one uplink from the ground to RUDAK and one downlink from RUDAK to the ground—provide the communications channel through an intelligent hardware interface. RUDAK is a German acronym for Regenerativer Umsetzer fuer digitale Amateurfunk-Kommunikation (regenerating translator for digital amateur radio communications).

What can RUDAK do for you? First, it acts like any other packet-radio station, by digipeating packets in real time between two stations that are both within view of the satellite.

Second, it will periodically insert bulletin packets into the downlink data flow, such as the momentary values for mean anomaly, orbit number, time, doppler shift (in reference to the equator), agc of the linear transponder, etc. The information is kept current by a constant data exchange between the satellite's main computer and the RUDAK processor.

Third, it will support a "robot" mode, which permits brief connects to the satellite for retrieving specific information of limited interest, such as orbital parameters, attitude information, transponder operating schedule, etc. To prevent a complete clogging of the system during periods of high traffic volume through RUDAK, a "list" type operation will be implemented. This operation will automatically limit the digipeated packets to those from stations that have signed onto the list by connecting to one of RUDAK's robot ports. This list will be constantly updated based on disconnects, timeouts, and other factors. Additionally, AMSAT or IARU bulletins can be periodically transmitted.

What does the RUDAK experiment consist of and what's necessary to participate? Let's start with the originating point of a packet that RUDAK will relay, the ground station. First, the packet is generated in the usual way in a TNC, but the internal FSK modem is disconnected. The transmit signal (data and clock) plus PTT are routed to a 2400-baud BPSK modulator, which forms a part of the transmitter on 1269.675 MHz $\pm$7.5 kHz to compensate for doppler and other frequency errors. Uplink power needs to be on the order of 20 Watts into a right-hand circularly polarized 15-dBi gain antenna, or approximately 650 Watts eirp.

The demodulator in the RUDAK receiver scans within a 15-kHz-wide capture window at a rate of 10 times per second. The appropriate TNC parameters will be provided in the automatic beacon packets. The packet is processed and routed to the downlink transmitter on 435.675 MHz using PSK modulation at 400 baud (or alternatively 1200 baud, depending on link conditions). This beacon will be in operation continually, except when mode B is switched on for brief intervals. Mode B is the 70 cm up/2 meter down mode that OSCAR 10 uses most of the time.

The RUDAK signal can be received using a standard SSB receiver, a 10-dBi right-hand circularly polarized antenna, and a preamplifier with a noise figure of 5 dB, which will achieve an estimated bit error rate of better than 10^{-5}. The audio signal is then fed into a PSK demodulator, where the data and clock signals are recovered. These two signals are sent to the corresponding TNC inputs.

The difference in uplink and downlink baud rates (2400/400) is due to the nature of the uncoordinated time-division multiple access to the system by the ground stations (ALOHA-TDMA). The collisions between stations on the uplink frequency result in only an average of 18% of the uplinked data getting through. This is because these stations can't hear each other. To balance out the downlink's 100% capability (only RUDAK is on the downlink), the uplink is run much faster. JAS-1 addresses the same problem in a different way—by offering multiple uplinks.

Uplink channel 1:	145.850 MHz
Uplink channel 2:	145.870 MHz
Uplink channel 3:	145.890 MHz
Uplink channel 4:	145.910 MHz
Uplink data format:	Manchester-coded FM, 1200 baud, AX.25
Downlink channel:	435.910 MHz
Downlink data format:	PSK, 1200 baud, AX.25
Downlink power:	1 Watt rms
Required uplink power:	100 Watts eirp

Table 2. Mode JD parameters.

Uplink frequency:	1269.675 MHz $\pm$7.5 kHz
Uplink data format:	2400-baud biphase PSK, AX.25 protocol
Required uplink power:	650 Watts eirp
Downlink frequency:	435.675 MHz
Downlink data format:	400-baud biphase PSK, AX.25 protocol
Downlink antenna gain:	10 dBi, RHCP

Table 3. RUDAK parameters.

WHAT'S IN A NAME?

The casual observer of the amateur satellite scene might get the impression that there are several more amateur satellites than there actually are. Depending on the vintage of an article—i.e., whether the spacecraft under discussion had been launched at that time or not—you may see a satellite called by a name other than the one you're used to. For example, UoSAT-A, UoSAT-1, and UoSAT-OSCAR-9 are all the same craft.

Any really good name will contain at least one acronym. OSCAR stands for Orbiting Satellite Carrying Amateur Radio. AMSAT refers to the name used by the Radio Amateur Satellite Corporation, headquartered in Washington DC. The AMSAT moniker was picked up by other national groups as they formed: e.g., AMSAT-DL (Germany), AMSAT-UK (England), and JAMSAT (Japan). The original AMSAT, based in the United States, is pondering the bylaw changes necessary to become AMSAT-NA (North America). AMSAT (no suffix) would then refer to the international community of radio amateur satellite enthusiasts. UoSAT means University of Surrey Satellite, referring to those satellites designed and built by radio amateurs and others at the University of Surrey in Guildford, England. These acronyms are strung together to form a satellite's name.

Satellites carry different names pre-launch than they do post-launch. There are several reasons, perhaps one is for the same reason you say "break a leg" backstage before the curtain goes up. It also keeps order of manufacture separate from order of launch, for those lucky enough to have more than one in progress at a time. Satellites are usually lettered before launch, and numbered after. This is true in industry as well; LANDSAT-D became LANDSAT-4 after reaching orbit. Spacecraft that don't make orbit don't get numbers. The ARIANE launcher for AMSAT's Phase-3A spacecraft failed shortly after liftoff, and it never became OSCAR-9. The second Phase-3 model built, Phase-3B, became OSCAR 10 because UoSAT-A beat it into orbit. Simple, see?

One other confusing factor is UoSAT-2 versus UoSAT-OSCAR-11 (abbreviated Uo-11). These are both post-launch names for UoSAT-B, and both names are used at various times in various places. The Uo-11 mission patch says UoSAT-2, the QSL card says UoSAT-OSCAR-11. Keep on your toes and you won't get caught.

A possible confusion on the horizon is Japan's JAS-1. Will it remain JAS-1 once on orbit? Will they want it to have an OSCAR number, and will it be abbreviated JO-n? Only time will tell. It seems a safe bet that Phase-3C will get a name in the AO-n series.

The Russian amateur satellites are usually given numbers In the RS series. See page 3-8 in reference 1.

It's easy to imagine how just listening to the downlink will provide interesting information on communications conditions—worldwide QSOs as well as general bulletins. Since the design philosophy of the communications links has been directed toward supporting individual users, it is recommended that stations make normal QSO-type contacts rather than set up gateway stations to transfer large blocks (e.g., file transfers, mailboxes). As the satellite is visible for long periods of time per orbit, the QSOs can occur in real-time rather than being handled in a store-and-forward fashion.

Ground-Station Digital Requirements

A RUDAK ground station (see Fig. 4) makes use of a regular packet terminal node controller (TNC). For the majority of the TNCs—e.g., TAPR TNC-1, AEA PKT-1, or Heath HD-4040—the only software modification required is an updated EPROM to handle a hardware bug in the WD-1933/35 HDLC controller. Otherwise, only a PSK modem for 400/2400 bps has to be connected to the external modem jack in the TNC.

Other TNCs, such as the Kantronics Packet Communicator, or various software solutions are unfortunately not suitable due to the software and/or hardware restrictions. The TNC must be capable of operating full duplex at different transmit/receive baud rates and support the connection of an external modem. The TNC-2-type TNCs need to have a wire added to permit external data clocking.

Besides the normal equipment, a RUDAK User Interface is required, which is under development by the RUDAK group and AMSAT-DL. This interface consists of an upconverter (which translates a 2m signal to 24 cm and modulates the carrier with 2400-bps BPSK) and the AMSAT-AFREG, the BPSK demodulator for the 400-bps downlink. Additionally, various buffers and controls for switching the different signal paths and a power supply are needed. The various schematics, especially for the AMSAT-AFREG and the upconverter, will be published by AMSAT-DL when the design is completed.

RUDAK Hardware

How does RUDAK work? RUDAK is a nonlinear transponder, which is totally separate from the linear L-band transponder and its associated agc level, even though the rf and i-f stages are housed in the mode-L transponder. The BPSK demodulator, the processor unit, and the power conditioning unit are installed in a separate housing, consisting of two chambers. Photo E shows the processor unit side of engineering prototype model #2; Photo F shows the wire-wrap version on the test bench. At the time this article was prepared, the flight version had just been completed and tested, prior to shipment to Golden, Colorado, for satellite integration.

What kind of hardware is used? The center piece of the RUDAK experiment is the processor. Its structure resembles an 8-bit home computer with a 64K addressing range. The CPU, a 65SC02, is a CMOS version from the well-known 6500 processor family. The RAM section consists of 56K, organized as 7K x 8K.

Out of all of the various new intelligent communications controllers, the well-known Z80-SIO (84C40) was selected for the AX.25 interface, as it was the only one available in CMOS when engineering work began. A second interface uses a 65SC22 VIA to provide data and program exchange with the satellite's main computer.

The ROM operating system contains a minimal operating system, consisting of the relevant routines needed for processor initialization prior to loading the main operating system, including RAM tests and initial telemetry. This arrangement assures the independent programmability of RUDAK, even in orbit. The main operating system is a variant of the IPS operating system, developed for OSCAR-10 by Dr. Karl Meinzer DJ4ZC. Measurements indicate that the power consumption of the entire 64K computer will be considerably less than 500 mW!

By the time this article is published, many steps will have been performed to prepare RUDAK and the satellite for launch, including thermal vacuum testing, vibration testing, and system performance testing. Photos G and H show a few members of the RUDAK team from Munich, West Germany, at work.

Where do I get more information? A user manual is in preparation, which will contain complete user information, such as schematics and parts lists to build the special equipment required for RUDAK operation, operating guidelines, link parameters, and access procedures for the robot modes. Various AMSAT-DL and AMSAT-NA publications will carry information on RUDAK. The Uo-9 and Uo-11 spacecraft will carry current information as the pre-launch, launch, and checkout activities occur.

WRAPUP

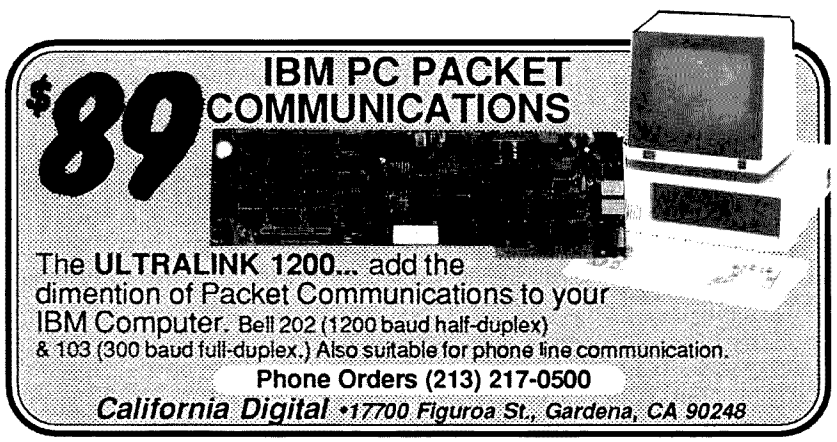
If you are interested in digits in space, 1986 should be a banner year. If you are interested in passing data through the network, you should be aware that in the future, much of the DX traffic will pass through the satellites discussed here. For the most in-depth coverage of the amateur satellite program, join one of the AMSAT organizations worldwide and get their journals. Come on up! ■

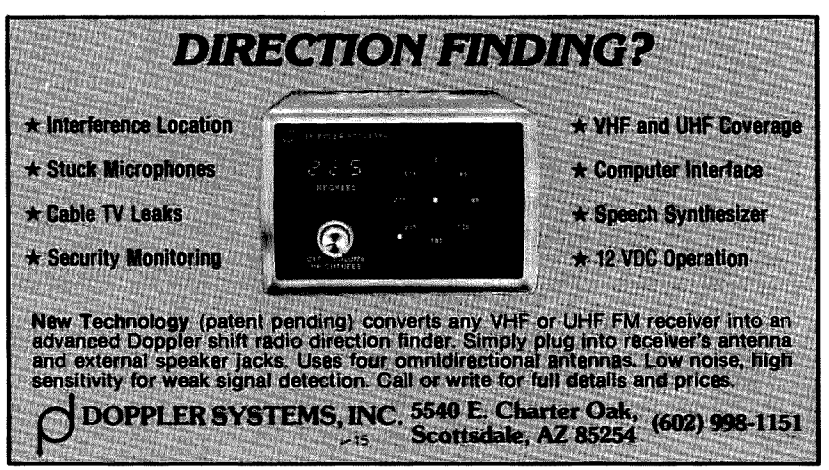
References

1. Martin R. Davidoff K2UBC, *The Satellite Experimenters Handbook*, ARRL, 1984.
2. H. Price NK6K and J. Ward K8KA, "The Uo-11 DCE Message Store-and-Forward System," Proceedings of the 5th ARRL Computer Networking Conference, ARRL, 1986.

Acknowledgements

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Connect Alarm!

Let your TNC call you when it has something to say.

The packet mode of communication is becoming one of the most popular phases of amateur radio. One of my projects upon recent retirement was to get a packet system assembled and in operation, initially on VHF, then expanding it to HF capability.

One of the first packet-gadget things I built for my TAPR-1 TNC was a connect-alert unit. The idea for this gadget was given to me by Gervie W7FEN, who already had added it to his system. I built the little unit and it worked as expected. A few months later, Louie WA7BHK bought an AEA PK-80 TNC, and having seen my system, asked me if the connect-alert portion of that circuit could be used on his TNC.

A look at the circuit of the PK-80, which is a clone of the TAPR-2 TNC, revealed that the desired signals and power for the alert circuit could be taken from the DB25 (J1) connector on the rear of the TNC. No internal connections requiring opening up of the PK-80 were necessary. A connect-alert unit was built and hooked to Louie's TNC. The little beeper sounds off as designed whenever there is a connect to his system.

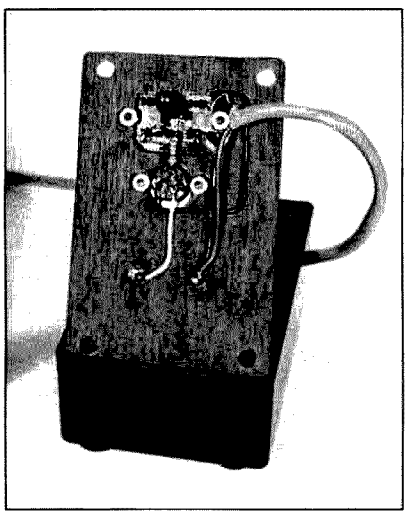


Photo A. Inside the connect-alert unit.

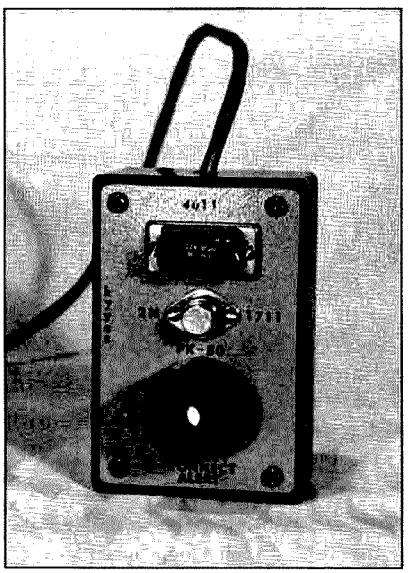


Photo B. The completed alarm.

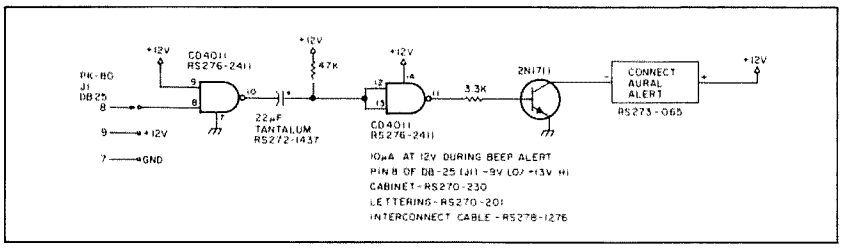


Fig. 1. Schematic diagram.

Construction

The little Packet Connect Aural Alert unit was built in a small plastic cabinet. The metal cover was replaced with a piece of Formica cabinet-top material to reduce the possibility of unwanted short circuits. The plastic sonic beeper unit was attached to the cover by a dab of epoxy cement. A small terminal lug strip was attached to the underside of the plastic cover to support the few components used in the circuit. (Be sure to observe the proper polarity of the tantalum condenser and the sonic alert unit when connecting them into the circuit.)

Testing

The circuit of the connect-alert unit is easily bench-tested by applying 12 volts to the proper points and then momentarily connecting pin 8 of the CD4011 to ground, then to plus 12 volts. If all is wired correctly, the beeper will sound off with a short shrill burst of sound.

Operation

With the alert unit control cable wired properly to pins 7, 8, and 9 of the DB25 (J1) connector for the PK-80, at power-up of the PK-80 a short beep should be heard from the unit. This is a quick self-test feature of the system. Each time thereafter when a connect is made with another station the aural alert beep will be heard.

This packet gadget should be of help to those getting set up for the latest and most interesting world of packet communication. Best of luck, and CWUL (Connect With You Later). ■

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Survival Training For Mountaintop Digipeaters

A ROM with a view.

It was mid-afternoon, late by mountaintop standards. From the ground, the clouds seemed motionless. The air was moist, still, and quiet. Up on the tower it was another story. Greg WB6ASR, leaning unsupported 50 feet above the ground, was constructing an antenna on the tower from parts pulled from his parka pockets. Fifty-mile-per-hour gusts squeezed the moisture from the cloud onto anything they touched. It was cold, it was wet, and we were late.

Later, with the antenna constructed and coax routed, we repaired to the building to continue testing the digipeater we were fixing. Finally satisfied that the digipeater was operational, we packed up the wattmeters, the portable computers, and the multiple toolboxes. We had just installed a brand new radio and new switching power supply. We had upgraded the digital hardware and installed the latest version of the digipeater software. And, as a final precaution, we had installed a watchdog timer, which would perform a "hard" reboot of the digipeater every 15 minutes. Any single improvement would have been enough; we did them all.

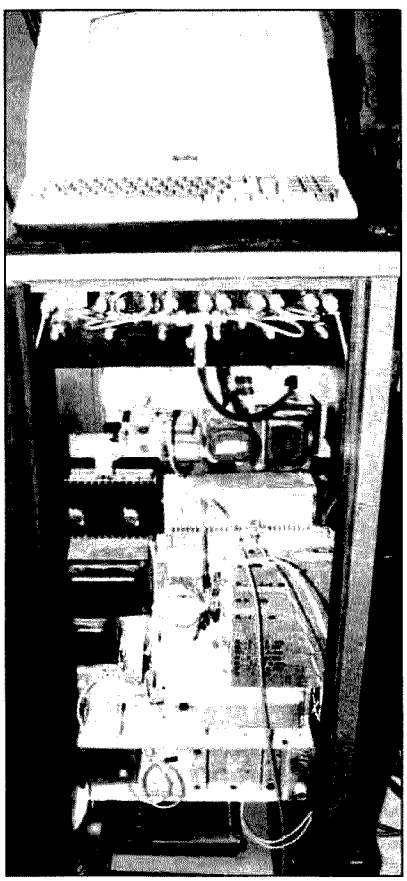


Photo A. Well-dressed mountaintop equipment racks now sport computer terminals. This digipeater requires 5-1/4" of this equipment bay.



Photo B. A two-meter pass cavity is much like an antenna: If it is small enough to be convenient, it is too small. This one is 24" tall and 9" in diameter.

It was very late when we finally arrived home. No matter. We *had* to test the digipeater, now so far away. It was still there. It worked well.

As the uptime data accumulated over the next few weeks, it became obvious that we had done well. This was another "zero-downtime" site. Then, three weeks later, a seven-minute outage. The next day, another. Without pattern, without reason, and a five-hour drive from civilization, our digipeater was hiccuping. Without the watchdog timer, it would have gone down for good.

Most users were unaware of the difficulties at our digipeater. It was heavily used and seemed reliable. Only we saw the downtime statistics piling up; we began to plan our next trip to the hill.

Introduction

This article describes a network of mountaintop digital repeaters covering the state of California. This network was installed by our radio club, the W6AMT ARC, in early 1985 and has been in continuous use ever since. Fig. 1 is a map of the system showing the relative locations of the major sites and California population centers.

This article is divided into three parts: the goals of the network, the trials and tribulations of putting (and keeping) the network

components up, and the direction the network is taking.

Mountaintop Digipeater Networks

Our first step in designing our communication network was to define the goals of the network: We wanted to move data reliably, expand the network as technology progressed, serve the major population centers in California, and have fun building it.

The first part of the network structure to plan was the locations of the digipeaters (digital repeaters). These locations were dictated by the major population centers in California. The proximity of the digipeaters was determined by their range and the desire to have as little overlap (mutual interference) as possible. As soon as the ideal locations for network digipeaters became settled, site acquisition started.

The hardware for the network was selected with a design goal of zero-downtime. Previous experience in mountaintop remote-base and voice-repeater equipment was a good start: There was no desire to invent anything if an acceptable solution was already available. Many industry professionals were consulted and potential pitfalls were identified in advance. Unfortunately, there was little real experience in combining mountaintops, computers, and radios, so we fell somewhat short of zero-downtime.

Finally, we had to choose the software for the network. It was not thought to be an issue at first but has become the major issue within the community. Network software will be discussed in greater detail later in this article and in other articles in this issue. Additionally, a bibliography is included for the serious digipeater student.

Selecting Digipeater Sites

There are several methods that can be used to cover California with reliable data communications. They fall into two generic categories: low-level digipeaters and high-level digipeaters.

We describe a digipeater as "low level" when it is planned to have a range of about 20 miles—the range of most "home" digipeaters. Building an amateur digital communications network with many low-level machines has several advantages. Since by implication such a network would be composed primarily of home stations, the cost to our organization would actually be less; all we would have to do to get the coverage we wanted would be to "find" the stations that were in the "right" places. Easy. This network would also be *much* easier to maintain because each node would take care of itself.

There are also some disadvantages. Sometimes there are *no* people in the gaps between population centers. Other times there are too many people to allow "picking" one without everyone else asking, "Why not me?" Additionally, a low-level digipeater network has a fatal flaw: It requires more "hops" in any long path connection than the packet-radio lingua franca, AX.25, will allow. Eight digipeaters are all you can request, and there were too many miles between major population centers for this number to be sufficient. The design goal was to have Portland, Oregon, connect to Los Angeles with those eight hops. Greater distances were to be handled by using mailboxes along the way.

Another failing of a low-level digipeater network is that paths would always be changing; since the network depends on many

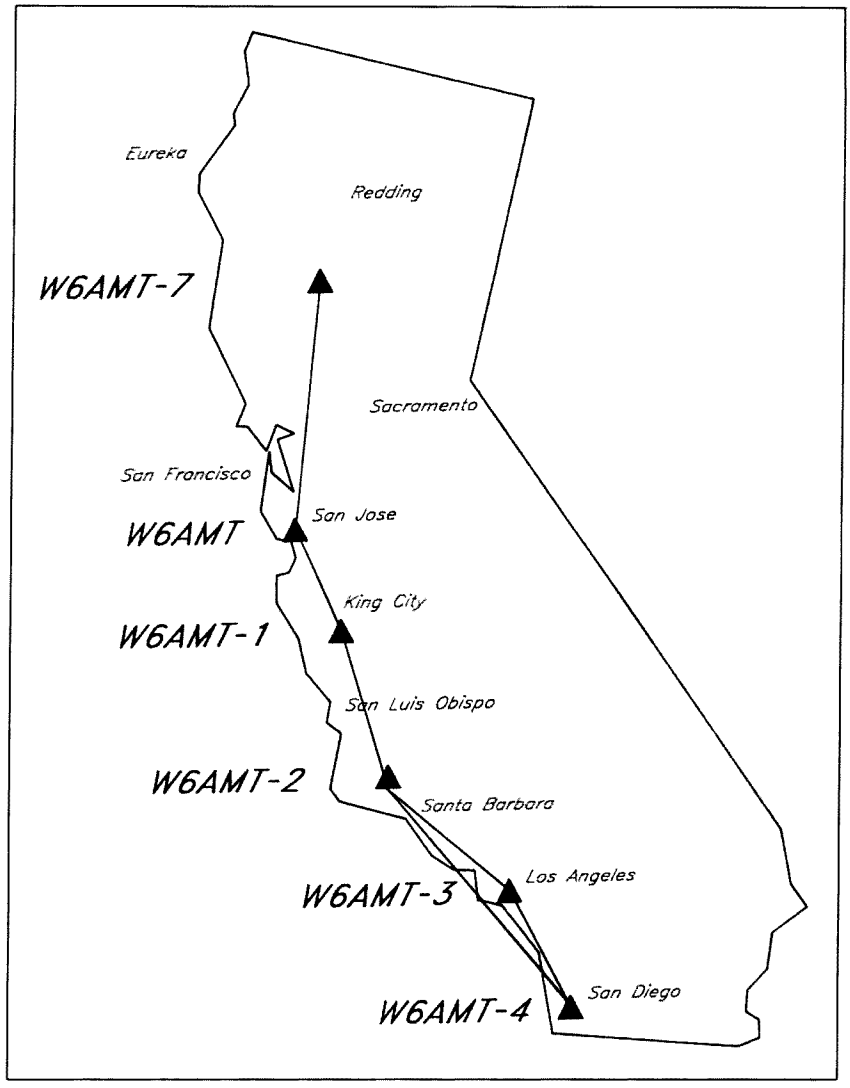


Fig. 1. The AMT Packet Radio Network on 145.01 MHz as of May, 1986 (diagram by WB6ASR).

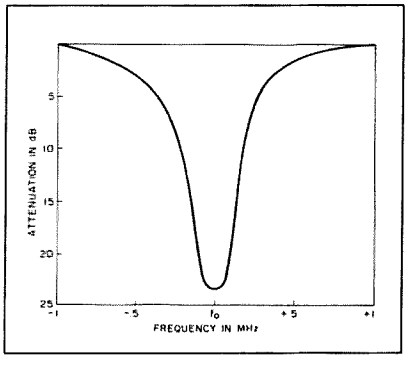


Fig. 2(a). Notch-cavity response curve.

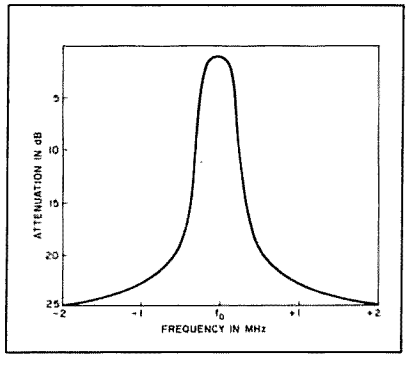


Fig. 2(b). Pass-cavity response curve.

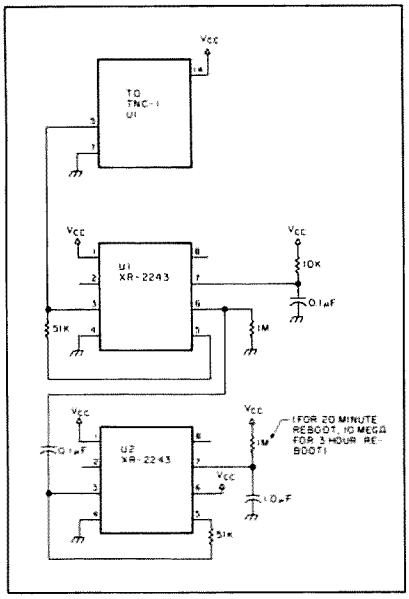


Fig. 3. Remote-site watchdog timer.

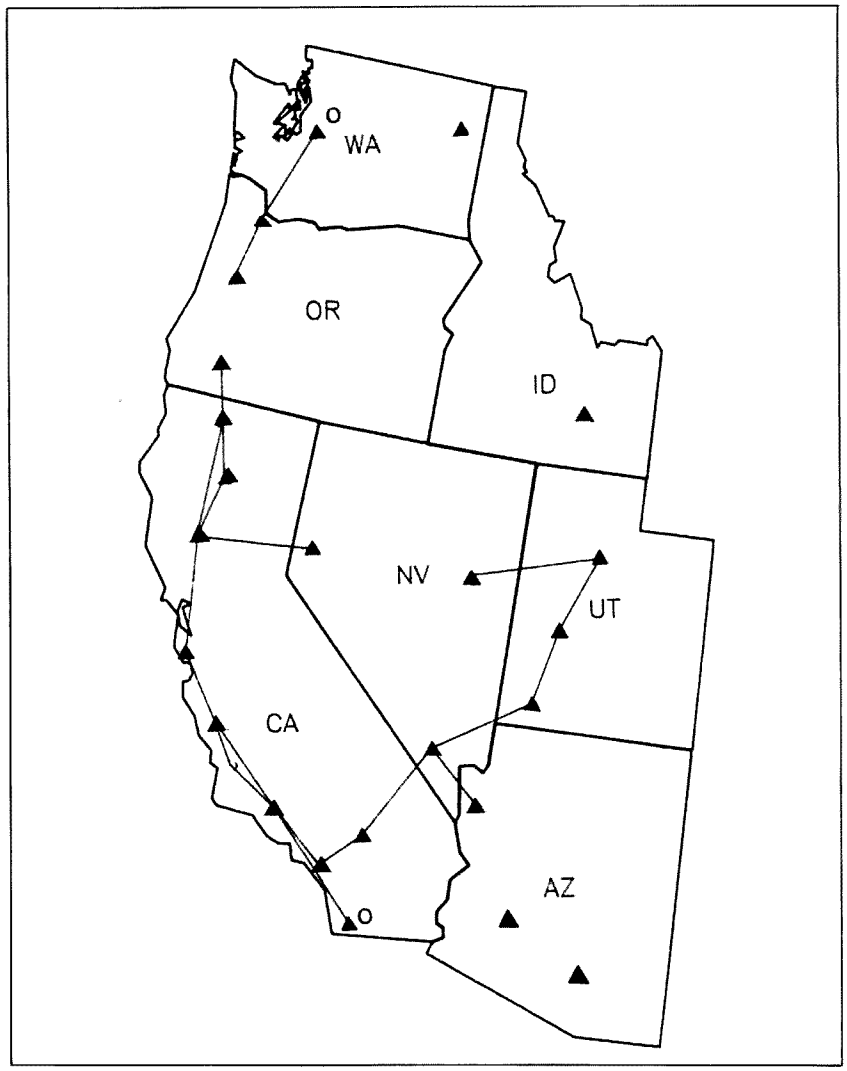


Fig. 4. WESTNET as of May, 1986. Triangles represent digipeaters and circles represent mailboxes (diagram by WB6ASR).

home stations, there would be a high turnover as the operator got bored and turned his station to other interests. Therefore, constructing a network for California from low-level digipeaters was eliminated early in the planning process.

The network topology we eventually chose was a network composed almost entirely of high-level digipeaters. "High level" is defined here as locations suitable for wide area coverage of the kind employed by voice repeaters. These sites were generally about 4,000 feet (more than 1,000 meters) in elevation and located so as to cover the population centers we desired.

Most of the advantages of the high-level digipeaters are obvious: There was *less* hardware in the network, fewer hops were required to cover a given distance, and, since the hardware and locations would be managed by our club, the network topology would be stable.

It is a truism within present amateur digital networks that the data throughput on even a slightly loaded network goes down *very* rapidly with an increasing number of hops. Most connections are futile if they contain more than four digipeaters. Thus, the farther you can go between digipeats, the farther your "digital range."

There are, of course, disadvantages with the high-level network. There is the problem of maintaining hardware and software on mountaintops, which are sometimes a day's drive from civilization. Additionally, it turned out that computers and mountaintops do not get along very well together.

Hardware Issues

Because high-level digipeater sites tend to be placed well away from civilization, hardware maintenance must be accomplished after a long drive. Problems can be minimized if the hardware is packaged and tested very thoroughly in a configuration that closely resembles the final one.

Another site maintenance difficulty that became obvious was that we were trying to adapt hardware and software into a system in which none of the component parts were designed to work. One would expect to have some problems where corners were cut as an acknowledgment of budgetary constraints. But who would ever expect software that is "solid" at a home station to misbehave when used for a hilltop digipeater? Trying to foresee all difficulties in advance is futile; we discuss those we encountered and invite correspondence.

When we put up our first digipeater, it was basically just a transported home station. We had some experience in the environment of a mountaintop and figured that we knew what the radios would do. As for the computer stuff, "What could go wrong? After all, it's digital!" Radio amateurs, however, have had little experience with hilltop computers.

The fact that we have a network up that carries as much traffic as it does shows that you do *not* have to go out and buy expensive commercial equipment of possibly limited availability; you merely should be aware of the environment your equipment is going to be immersed in. Remote locations are a much more hazardous environment than we at first thought—but almost anything can eventually be managed if anticipated.

We Picked Mountaintops

Having looked at the pros and cons of building a mountaintop digital communication network, and despite the fact that there was no one else in California to "connect" to on 145.01 MHz, we decided to put our hardware up. The digipeaters went up one by one over a period of about three months. This turned out to be fortuitous timing as it corresponded to some very explosive

growth in the packeteer population within California.

That the approach of placing digipeaters high and far apart was a successful one was immediately apparent. Single-hop QSOs covering more than 200 miles became commonplace. Other states became workable for the first time over paths that were unknown before this time. An example of this was the connection in early March, 1985, of Jack WA7DIA using his WA7DIA-1 digipeater in Reno, Nevada. Previously unheard-of distances became an everyday occurrence. Packets were "heard" in Oregon and in the mountains near Las Vegas. The outcome was obvious to those with foresight: network saturation.

Some disadvantages also became apparent. With a single digipeater in sight of so many stations, users started to wonder why they couldn't get digipeated. The common complaint was, "Why doesn't the digipeater hear me? I'm running 200 Watts." The digipeater itself usually ran some tens of Watts (which was plenty), so what *was* the problem?

We wandered up to the hill for a prime-time look at the problem. We hooked up our terminal and sat back for an enjoyable operating session. When we turned it on, we were amazed: We saw nothing but continuous packets going by. People trying to use the digipeater, people using other digipeaters within range, people talking to people simplex. People and more people. It was a wonder that anything got through at all! We called this the "white lightning" effect and are still wondering what to do about it.

Another problem that showed up early on was the number of "Dufus" packets. Dufus is that brand new packeteer. He is still trying to figure out all the settings and options on his latest TNC. You gather he is obviously a little lost from the things he is saying to others who try to contact him. He has lots of company. I guess it is to be expected since packet radio is still a very new mode. There were so many problems with Dufus and his friends that sometimes our digipeaters carried beacons outlining suggested operator settings for the TNCs "out there."

Mountaintop Characteristics

Our club has many great memories of mountaintops. We spent many VHF/UHF contests atop hills. The weather got a little chilly but it was never terrifying. Putting hardware up and leaving it up is quite different. The benign rocks and trees you see during the day when you are tightening bolts and routing coax become downright hostile when you turn your back. Exposed hardware does not merely break, it disappears.

Weather

The primary villain is wind. If the weather gets cold, ice and snow will also add to the misery your hardware must undergo. Ice increases the wind load, while snow, if deep enough, will make a shambles of your swr. Coaxial-cable routing should be done carefully. If routed where it will swing in the wind or be used as a support by someone else working on the mountain, it will not last. The last thing to remember is to have plenty of weatherproofing putty on hand to seal the weather out at the coaxial-cable entry point to the building.

Problem	Solution
NOVRAMs	PROMs
v2 transfer	Better software
Drift with temperature	Better pots for the TNC
RFI	Toroids, filters, chassis sanding, grounding, 9913 coax, bypassing, etc.
EMI	Ditto
Relays	IC-28Hs, IC-27Hs, GE-MVPs, Motorola Moxys
Sabotage	Locked cabinets—remember to lock up cavities
Desense	Cavities, antenna placement, coax routing, prayers

Table 1.

Mountaintops display extremes of temperature—sometimes more than 100 degrees in a day. Hopefully, the shelter housing the digipeater moderates the outside temperature somewhat. There will be both short- and long-range temperature swings to endure.

One problem we found with some of our digipeaters was that the modem tones produced by the TNC drifted. The drift was compounded by the changes in humidity accompanying the temperature changes. After fighting it for a while, we gave in and replaced the cheap carbon single-turn pots that came with our TNCs with 10-turn wire-wound pots. The drift is still there, but the TNC can go years without recalibration.

Before we get off the subject, it should be mentioned that heat, being the great killer of electronic equipment, should not be allowed to build up. All the sites should have exhaust fans that are placed to minimize intake of dust. Mountains are quite dusty.

Power

Another topic unique to hilltops is the kind of power you are going to have to use for the digipeater. The power that gets supplied to the top (if you are fortunate to have commercial power supplied to the site) arrives after a long journey. If you put your trusty power-line monitor on ac, you would get a picture of chaos. Power dips, voltage surges, and lightning-induced peaks all are trying to get through your power supply and kill your digipeater.

If the hill supplies battery backup that someone else has made operational and is maintaining, and you are invited to use it, by all means, go ahead. However, if you are thinking of adding battery backup to your digipeater, realize that there are many costs associated with batteries. They take up a lot of space, they require maintenance, and they are expensive. On the other hand, batteries might be the only way to get reasonable uptime from your digipeater.

Some mountaintops have an emergency backup generator. This is usually a beast of a generator that is set to come on a given time after the commercial mains drop out. This power source has all the problems of commercial power with the added feature that the line frequency can vary. This is a problem for some types of switching power supplies.

Another topic worth covering while discussing digipeater power sources is the trade-off between switching and linear power supplies. Switching power supplies operate more efficiently, weigh less per Watt, and occupy less space. Because they are more efficient, they generate less heat. Thus, all things being equal, switching power supplies increase system reliability. The trade-off is that "switchers" cost more, and the less expensive ones are sensitive to power-line quality. We use switching power supplies in most of our sites primarily for saving space and have been very satisfied with the resultant system reliability.

Electronic Environment

One aspect of mountaintop operation that is not confined to mountains alone is the number and variety of rf generators that can be located very close to the digipeater. Some sites have very high power transmitters operating continuously. This has the advantage of presenting a known environment to operate in, but also the potential disadvantage of producing very high rf seemingly everywhere. Other sites have a larger number of much lower powered transmitters, which operate at irregular intervals. It is often difficult to perfect the digipeater in this type of environment because the problems occur when two or more of the co-located transmitters transmit simultaneously.

The best method we have found for obtaining reliable rf performance at the digipeater is to utilize a "pass cavity" or two between the digipeater radio(s) and the antennas. This is possible because the digipeater is a simplex device: It operates on a single frequency for both transmit and receive. A properly adjusted pass cavity blocks all other non-harmonically related rf energy from the digipeater radio's "front end." It has the added benefit of attenuating any spurious energy produced by the digipeater. This makes the packet-radio box a good neighbor. Some sites have a particularly tough problem with co-located transmitters that are also very close in frequency. This type of problem can be solved through the use of a "notch cavity," which has its notch set to the interfering transmitter's frequency. A good quality cavi-

ty can be quite sharp, as indicated by Figs. 2(a) and 2(b). It is one of the best investments anyone considering a high-level digipeater can make.

Operating a TNC in close proximity to a great deal of rf energy was not one of our design considerations. We had problems with rf getting into the TNC and causing anomalous performance. We had already put the cavity on the radio, so other radios were not bothering our TNC—our own transmitter was. And it was a hassle. Everything would work perfectly until we tightened the last screw. Since we could no longer test the TNC ourselves (because we had to disconnect our terminal), we had to depend on the reports of others. They would say that the TNC was "loud, but it didn't transmit very long." We named this problem the "short problem." It turned out that when our TNC got a large enough dose of our own rf, it would transmit only quarter-second bleeps of bogus data. This was eventually cured by bypassing the TNC leads (mostly power leads), putting toroids on the leads to choke the rf, and, as a temporary expedient, reducing the power out of the digipeater transmitter.

EMI and RFI

One of the problems in operating radio equipment near computers is that computers are "noisy." They generate noise and spurious signals all over the spectrum. This problem has the name electromagnetic interference (EMI). It sometimes seems that most of the popular TNCs had one of their loudest birdies right on the frequency we chose to put the digipeater on. On either side of 145.01 MHz, everything was quiet, but tune to .01 and there was an S9, slightly off-channel signal!

There is no easy solution to this. The signal was there and didn't want to be moved. We turned to the books on the subject, which proposed all sorts of solutions. We tried them in order, each improving the situation a bit, until we were satisfied.

The most important step in reducing the ill effects on our radio from the signals being generated by the digital circuitry in the TNC was to bite the bullet and shield the TNC from the radio. This meant that the TNC enclosure had to be made into an rf-tight box. After scraping the paint off the box (to better the electrical contact) and putting more screws into the sides, we tackled the power and signal leads coming out of the TNC enclosure. One last tactic was to use high-quality, well-shielded coax. We wanted signals to enter the radio only from the antenna, not to come into the coax unintended.

Equipment Selection

Mountaintop digipeaters are no fun if they are down, and they are down longer if they are hard to maintain. Several sites are far enough away from the home QTH that the distance we had to travel became intimidating. Anything we could do to forestall a trip to the hill was worth the effort. Equipment was selected (after the first digipeaters taught us the hard way) for reliable service in digipeater use. Digipeater use is quite different from most other services. Its characteristics are low duty cycle (the average packet is a second or so long) and a large number of transmissions per unit time. A busy packet channel will average more than ten packets (transmissions) per minute...all up and down the state...thousands per day.

The equipment of choice is solid-state throughout, has no mechanical relays anywhere in the PTT (push-to-talk) logic, recovers unaided from vagaries in the power supplies, is capable of being well (enough) shielded, and reboots itself if the computer goes down. Suitable equipment is available in the amateur radio or commercial radio industries.

The only piece of hardware that we could not buy off the shelf and either use directly or modify for use was the watchdog timer mentioned earlier. We built ours to be "field installable" on a small PC board that connected to the TNC via a ribbon cable. We simply removed U1 (of our TNC-1s) and plugged our board in. The reset time was set to reboot fairly often. The thought was that if we rebooted every 15 or so minutes, we would lose a packet due to rebooting less than one tenth of one percent of the time. Fig. 3 is a schematic of the watchdog and has details of operation and installation.

Software Challenges

Not all the problems confronting the mountaintop digipeater are hardware. The rest are software or software related. The protocol that all TNCs "speak" to each other is called AX.25. It was derived directly from an internationally established digital communication protocol, X.25. This protocol is specified in two versions with version two (AX.25 v2) being somewhat more powerful. As users of the digipeater system started to use v2, it was discovered that the digipeaters in the network would not digipeat the v2 packets. We needed a bug fix. After casting about for some months, we got lucky and acquired some PROMs with software that would digipeat v2 packets. Some TNCs still being produced cannot handle AX.25 v2 packets. Be careful if you are planning a digipeater.

The only other software-related problem within the scope of this article is not really a software problem at all. It turns out that the TNC-1s we were using would "forget" their own callsign. The callsign information is held in a nonvolatile RAM, in which the user customizes his TNC. Ours became volatile. We joked that NOVRAMs did not work above 2,000 feet, but the real culprit was the TNC itself. A design error was occasionally corrupting the NOVRAM. The good news was that it happened only when rebooting. The bad news was that our digipeaters were being hard-booted up to 50 times a day by their watchdogs. The solution turned out to be straightforward: We "blasted" the digipeater call and other particulars into the PROMs that held the software and did not use the unreliable NOVRAM.

Table 1 lists most of the problems we encountered and the solutions we implemented. The solutions are not perhaps the most elegant, but they are guaranteed to work.

Future Direction for High-Level Networks

The following is a subjective discussion of some future directions amateur digital communication networks will be taking:

- The mountaintop nodes of future networks will have much more "power" than today's meager digipeaters.

Several trends and facts will drive the mountaintops to provide many more user services than they do now. Any attempts to leave the complex stuff on the ground invariably require links to the hilltops. These links are sources of error and network failure. Keeping the complex stuff on the mountain eliminates a lot of hardware; network reliability is the prime driver.

- These will become dual-port and then multi-port digipeaters.

Dual-port and multi-port digipeaters are

GLOSSARY

Connect	A situation in which both you and the station you are talking to are in synchronization. His computer is talking to your computer, and all you see is error-free text being printed. Can be several hops.
Digipeater	Digital repeater. Receives data packet over the air and decodes the packet to see if retransmission is requested. If so, the digipeater retransmits the data.
EMI	Electromagnetic interference—generic term used here to describe interfering signals that are unintentionally passed around your equipment.
Hops	Digipeater "relays."
LAN	Local area network—those operators who can link to you through the same digipeater.
Link	See connect.
Packeteer	Packet radio operator.
RFI	Radio frequency interference—generic term for the situation in which your radios are causing malfunctions in other equipment.
TNC	Terminal node controller—the box between your radio and the computer terminal. Contains a computer that performs the retransmission and "link maintenance"—tries to synthesize an error-free path.
User	An operator who believes everything you tell him.
WAN	Wide area net—all the operators who are capable of being connected to.

necessary to allow the LANs that have developed on separate frequencies (and perhaps that have separate digital protocols) to interconnect. HF, satellites, and other developing communication technologies are going to want to be interconnected.

• We will see common use of hilltop mass-storage systems.

There is just too much flux in the software amateur networks are running to update your system with a new set of PROMs with every new software release. Uploading data from the ground is the preferred method of updating both digipeaters and geosynchronous satellites. The former are little more accessible than the latter. Additionally, there is much data that will be collected by the mountaintop digipeater for its own use. Winchester drives on mountaintops are just one cost-effective solution.

• There will be several different protocols in use in the near future. Therefore, the networks are going to have to support multiple protocols to be maximally useful.

There is no dearth of processor power these days. There is no excuse not to put every protocol that will fit into the computer's memory onto the hilltops.

• Other resources that mountaintop digipeaters (or digipeaters in general) will be providing users are mailboxes, execution servers, and data base servers. This is just a further economy of overall network resources.

Future software, though more complex, will be much more reliable. One of the frustrations of present TNCs is that supporting the software by adding features or squashing bugs is very difficult. Software that is easy to support will be used. Support includes available source code, relatively common support environment, and available expertise in the details of said software.

Summary

When we first planned a statewide network, the task to be accomplished seemed obvious: move data reliably. As our thinking progressed, additional goals became clear. There were other (more or less) compatible digipeaters to link to. There were problems with overlapping coverage and propagation-dependent paths. There was (sigh) intentional interference. There were changes to the underlying AX.25 protocol which necessitated software upgrade to the hilltops. There were plans, plans, and more plans. The future had to be accommodated; the network was in danger of being obsolete before it was completely operational.

Now, the network is up and there are many other groups and individuals linked together. Fig. 4 illustrates the extent of the Western United States packet-radio network (commonly called WESTNET). Development proceeds at a rapid pace (for amateur radio). One thing is certain: Tomorrow's networks will be more fun than those of today. ■

Reference

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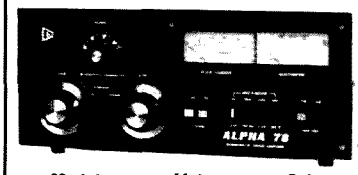
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Beyond Level Two

High-level networking comes to packet radio.

Most of the packet articles in this issue of 73 *have been aimed at non-packet users or new packet users. A few were targeted for second-year students. This article is for the user who is ready to take the advanced packet course. It discusses issues at the center of the next round of technical development. If you are at the advanced level, read on and get ready to help out. If you aren't quite there yet, scan through and start to pick up some of the terms and concepts. If this issue was your first exposure to packet radio, take heart, this space could have been four more pages of Never Say Die.—NK6K*

It is an exciting time for amateur packet radio. In this young facet of our hobby, things happen fast. Just as the new packeteer is getting started, he or she is immediately bombarded with all sorts of arcane buzzwords like "protocols" and "layering" and "level 3," spoken by people who always seem to be arguing passionately with each other, usually about things like "datagrams" and "virtual circuits." The poor neophyte must think: "It was bad enough when computers came to ham radio, but this is *communications*, a subject I'm supposed to know something about!"

In this article I hope to dispel some of the mysteries surrounding the new developments in packet-radio protocol. This *is* communications, so there really isn't much that's fundamentally different from what you already know from being a ham. Computer networks are nothing more than automated traffic nets, using computers instead of human beings to move messages around. Of course a computer, being both faster and dumber than you or I, can't (and shouldn't try to) do everything in exactly the same way as a human. This often has quite an effect on what uses are (or aren't) practical. But the underlying ideas are the same, and I think you'll easily see them.

The Story So Far

As has long been the case with CW, phone, and RTTY, packet radio has standard procedures for initiating and terminating QSOs, and for exchanging information during the QSO. In computer lingo, such procedures are called protocols. The only real difference is that packet-radio protocols are much more formal than the protocols for, say, an SSB rag-chew. This is because packet-radio protocols are carried out by computers, which lack human traits—such as common sense. Every little detail, no matter how "obvious," has to be spelled out because computers will do exactly what you *tell* them to do, not necessarily what you want them to do.

Almost all amateur packet-radio work is currently done with what is commonly known as the "AX.25 Link Layer Protocol."[1] Virtually all the packet Terminal Node Controller (TNC) boards now sold have AX.25 programmed into them. AX.25 began life as the link-layer portion of the CCITT X.25 protocol.[2] X.25 is the protocol used by customers to access packet-switched public data networks operated by common carriers such as GTE Telenet and Uninet in the USA, and by the Postal, Telephone, and Telegraph (PTT) agencies in many other countries. The link-layer portion of X.25 is also known as LAPB (Link Access Procedures Balanced). LAPB itself belongs to a class of link procedures known as HDLC (High-level Data Link Control). HDLC was originally developed by IBM, and it is now an International Standards Organization (ISO) standard. (To quote Tanenbaum: "The nice thing about standards is that you have so many to choose from; furthermore, if you do not like any of them, you can just wait for next year's model."[6])

HDLC is popular in the commercial world, and several manufacturers make integrated circuits that support it. HDLC is a *synchronous* protocol; that is, it lacks the start and stop bits that surround each character in ordinary (asynchronous) RTTY and ASCII transmissions. This improves the efficiency of the transmission at the expense of slightly increased complexity.

As mentioned earlier, X.25/LAPB/HDLC is the protocol used on landline links into common-carrier networks. Since these links are "point-to-point" (i.e., they lack the one-to-many, "broadcast" nature of radio), LAPB lacks addressing. To make it usable on a shared radio channel, addresses (amateur callsigns) were added to LAPB, making AX.25. With this change, the shared rf channel became a true network, with packets implicitly "switched" among stations by virtue of the source and destination addresses always carried in each packet header. This is very similar to several commercial local area networks, the best known being Ethernet.[3] (Ethernet is often described as "packet radio on a cable.")

The underlying medium (coax cable or rf channel) is "stateless," that is, it "remembers" nothing from one packet to the next. Each packet must therefore contain all of the information necessary to get it to the proper destination. For this purpose, Ethernet and AX.25 both include full source and destination addresses in every packet, and the resulting packets are known as "datagrams." Since the notion of a "connection" requires something to remember who you are connected to, the endpoints have to do this themselves.

In Ethernet, connections (if desired) are left up to a separate, higher-level protocol; in AX.25, it is "built in" in the form of LAPB. AX.25 therefore consists of two halves: a lower "sublayer" that handles addressing on a packet-by-packet basis, and an upper sublayer based on LAPB that sets up a connection, retransmits packets when they are lost, and takes down the connection when it is no longer needed. It is possible to bypass AX.25's upper sublayer with the "UI" (Unnumbered Information) frame. UI frames are sent without regard to connections, guaranteed delivery, and so forth. Currently, the most common use of the UI frame is for broadcasting information (such as beacons) to all stations in a local area.

Why AX.25 Level 2 Isn't Enough

If the entire amateur "network" consisted of a common rf channel that allowed every user station in the world to communicate directly with everyone else (and assuming of course that this channel had enough capacity to handle everyone's traffic) our problems would be over. The closest we can come to this is a satellite channel. Even a satellite, though, can never see more than 1/2 of the world at any one time, has limited bandwidth, and requires specialized ground-station equipment. On the ground the problem is worse; only a tiny fraction of the stations one might want to communicate with are likely to be within direct VHF/UHF or even HF range.

Most networks in the world, not just the amateur ones, are like this. In order for most stations in the network to communicate, their

messages have to be relayed through intermediate stations, a practice familiar to hams from the very first days of amateur radio (and reflected in the second "R" in "ARRL"). The complications that result from this fact of life are what makes networking such a difficult, interesting, and/or lucrative (depending on your profession) problem. Problems such as routing (choosing one of many possible indirect paths through a web of transmission links), congestion control (alleviating or preventing traffic jams at "hot spots" in the network), and load sharing (getting the best use out of expensive investments) have occupied the minds of telephone company engineers, highway planners, and airline executives for many years. The amateur community is only now realizing the full scope of the challenges we face in building a practical, large-scale packet-radio network. Those who answer this challenge will find it a highly rewarding and educational experience.

As a temporary, partial solution to the lack of a universally accessible rf channel, AX.25 provides the "digipeater." This is a device that receives properly addressed packets and repeats them after a short delay, usually on the same channel. Digipeaters are very simple, stateless devices; they remember nothing from one packet to the next. Therefore, each packet to be routed through a digipeater must specify the digipeater's address. So we already have true networks out there, traversed by packets containing "source routes" (the list of digipeaters placed in each packet by the sender).

So AX.25 level 2 is certainly doing quite a bit more than its originally intended "link-layer" job. There also seems to be universal agreement that the current protocol by itself is just not up to the task. A network layer built solely out of digipeaters performs badly for the following reasons:

1. Acknowledgements in AX.25 are all end-to-end. If a packet is lost halfway down a chain of digipeaters, it must start all over again back at the source. While end-to-end acknowledgments are both necessary and sufficient to guarantee the *correctness* of a data transfer, it is obvious that performance can be very bad.

2. At present, digipeaters cannot automatically route packets based on destination addresses. As mentioned earlier, the sending station must specify in the packet the entire route to be followed. This can result in wastefully large packet headers, especially when a long chain of digipeaters is being traversed. Worse, the sending operator often does not know what digipeaters are available outside his local area, and even if he does he may not know which are the best routes to use. It *would* be possible to build a digipeater to route packets automatically based on their destination addresses. However, when routes change it is possible for the network to deliver packets in a different order than they were sent, and LAPB was never designed to handle this situation.

Digipeaters were intended as temporary stopgaps to provide connectivity until smarter "packet switches" could be built to replace them. The idea was that AX.25 level 2 connections would be established only between stations having a direct rf path, and that a higher-level protocol would be supported by these switches to relay actual user traffic. As everyone knows, the popularity of amateur packet radio virtually exploded before these protocols had a chance to be developed and tested.

Divide and Conquer

Before describing the work that is underway to build an amateur packet network that solves the problems associated with digipeaters, it is a good idea to review some helpful principles. A large, complex system (such as a computer network) is almost always more manageable when it is structured as a hierarchy. Virtually every organization with more than a few people (such as a business) is organized in this way, so this should be familiar to just about everyone.

"The nice thing about standards is that you have so many to choose from; furthermore, if you do not like any of them, you can just wait for next year's model."

Organizing systems into hierarchies is useful whether the "components" be hardware, software, or people. Consider a person who wants to send a letter. He or she addresses an envelope and puts the letter in a mailbox. It is picked up by the Postal Service, and depending on how far it must go, the letter may take several truck and plane rides and pass through several post offices before arriving at the destination.

People sending and receiving mail need not concern themselves with the inner workings of the postal system. These are unnecessary details most people don't need (or want) to know anything about, so they are hidden from view. In turn, mail clerks have no business reading the mail they handle. All the information they need to do their jobs is written on the outside of each envelope in a standard, well-defined way, and the contents of the letter are delivered unchanged. There are also envelopes inside of envelopes; for example, a batch of letters all going to San Francisco can be placed in a sack for shipment. Now the truck drivers or airline cargo handlers need not handle individual letters; they need look only at the single destination written on the outside of the sack.

Several key principles are in use here.

1. Detail hiding: Each level in the hierarchy hides the unimportant details of how it goes about its job from the levels above it.

2. Encapsulation: Each level expects that the information it passes through a lower level will emerge unchanged.

3. Procedural standardization: The procedures used for peer-peer communication (e.g., the language used by correspondents in their letters, the procedures for scheduling and tracking postal truck shipments) are agreed on by the parties involved.

4. Interface standardization: Each pair of adjacent layers must agree on the exact services to be provided and the language to be used for communication between the layers. For example, the postal services maintain lists of routing codes (zip codes in the U.S.) and standard abbreviations. It also expects to find destination addresses written on the outside of envelopes in a standard way.

Clearly, a well-organized, hierarchical structure (along with the features just listed) is vital for something as large as the postal system to function, and this is even more important in a computer network. The amateur packet-radio network has already become one of the most complex systems ever built by hams, and a clear picture of how all the pieces fit together is essential in making it all work.

Fortunately, there is much outside experience that we can draw from in designing our network. Packet switching originated in experiments begun in the late 1960s by the U.S. Defense Advanced Research Projects Agency (ARPA). These projects were so successful that by the mid-1970s companies were forming to market packet-switching services commercially. Efforts began to standardize the interface protocols between a public network and its users; this resulted in the widely used X.25 protocol.

Many similarities between the components of the networks built by different groups were seen. From the need to describe these components in a reasonably uniform way, the *International Standards Organization Reference Model for Open Systems Interconnection (ISO RM)* was devised.[4] The *ISO RM* defines a set of seven hierarchically arranged "layers," each providing functions often found in a computer network. It is very important to remember that the *ISO RM* is only a guide for describing existing computer networks. It was never intended to be a set of requirements for how they must be built, and in fact the component layers in many existing networks do not correspond exactly to those in the *ISO RM*.

The seven layers in the *ISO RM* are, from low to high: Physical, Link, Network, Transport, Session, Presentation, and Application. It is common to refer to a layer by level number, e.g., "level 1" is synonymous with the Physical layer, "level 2" with the Link layer, and so on. Since it takes a fair bit of space to properly cover the ISO model, I'll give just a brief outline here and refer the interested reader to any of the excellent descriptions that have appeared elsewhere.[5,6]

1. The Physical layer handles the electrical aspects of communication between two points. The pinouts of a connector, the modulation scheme of a modem, and the signaling rates are examples of things usually considered to be in this layer.

2. The Link layer handles the procedures for the transmission of blocks of data (often called frames) between two points in direct physical communication. It provides the means for distinguishing the beginning and end of each block of data, and usually ways to handle arbitrary data streams (transparency) as well. The link layer may or may not take special steps (such as retransmissions and acknowledgments) to improve reliability, although this is not always done.

3. The Network layer handles addressing and routing, essential facilities if a network is to have more than two stations and allow communication between stations that do not have a direct physical link (i.e., their communications have to be relayed through other stations).

4. The Transport layer is the first "end-to-end" layer; it manages network facilities on behalf of the higher layers and generally ensures the accuracy and reliability of data transfers on an end-to-end basis. It sometimes provides end-to-end "flow control," that is, it helps keep the destination (and the network) from becoming overloaded by sending data only when the destination is ready for it.

5. The Session layer is, unfortunately, somewhat vaguely defined. It is supposed to "manage" the transport facilities (although, in a sense, every layer "manages" the layer below it). It routes data between the transport protocol and the various program modules that require network services. It also provides special services that might be needed when a transport connection is established or torn down.

6. The Presentation layer loosely covers anything having to do with data formatting. Character sets (e.g., ASCII), the "escape sequences" used for special functions on CRT terminals, end-to-end encryption, and data compression are all generally thought of as Presentation layer functions.

7. The Application layer is the raison d'etre for all the other layers: It is the program which needs to communicate (presumably on behalf of a human user somewhere) with another program in a different computer system.

That the ISO model is still around is a good indication that it includes many fairly fundamental ideas, and so it is still useful in describing computer networks. But networking technology has evolved in the meantime, and so in many cases a layer whose "job" seemed well defined and necessary at the time is no longer considered very important; likewise, other layers become complex enough that many people begin to think of their tasks as really being several "sublayers."

Another view is the U.S. Department of Defense Protocol Reference Model (also known as the "ARPA Reference Model").[8] The ARPA model has only four layers (from low to high): Subnet, Internet, Host-Host, and Application. While similar in many respects to the ISO model, the fundamental concept in the ARPA model is the "internetwork" (the ARPA protocols are often referred to as the "Internet Protocols"). The Internet consists of an interconnected set of dissimilar "subnetworks," each with its own internal network protocol "underneath" the ARPA protocols in the hierarchy. This is just a generalized extension of the hierarchy concept wherein an entire network is treated as just one "link" in an even bigger "internetwork." There is only one protocol at the Internet layer, and this is naturally enough called the Internet Protocol (IP). The most important ARPA Host-Host protocols are the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).

There is still quite a bit of similarity between these two models. They are both based on the fundamental idea of a hierarchy of functions; each has functions which are done on an end-to-end basis and others which are not. What's important in both models is the relative position of a component in the hierarchy, not the fixed "level" designation it might have. (See [7] for an amusing proof that N = N + 1 for any value of N when the relative nature of layers is ignored).

Since ARPA pioneered the (now very popular) concept of "internetting," it was not reflected in the original *ISO RM*. Therefore, the *ISO RM* has begun to sprout "sublayers," particularly at the Network layer (level 3). ARPA's Subnet layer corresponds to everything from the lower half of the ISO Network layer ("level 3A") and down, while the ARPA Internet layer corresponds to the upper half of the ISO Network layer ("level 3B"). The ARPA Host-Host layer performs the functions usually associated with ISO levels 4 and 5 (Transport and Session), while Presentation layer functions were considered application-specific enough to be merged with the ARPA Application layer.

New Developments

Now that we've reviewed the ISO and ARPA models, the fact that "AX.25 level 2" does quite a bit more than "link-layer" functions should become clear. The addressing portion of AX.25 seems to correspond most closely to the ISO Network layer, while the LAPB portion (that part which manages connections and retransmits lost packets) seems most like the Transport layer. Now that we've laid down a "divide and conquer" foundation, we can finally discuss in detail the various proposals for solving the problems we have in our current network. This is, of course, where the real fun is. In a field as fast-moving as computer networking, plenty of heated controversies arise. Some things, like the order in which the bytes of a packet header should be transmitted on a channel, are akin to deciding whether cars should be driven on the left or right side of the road. Clearly, which procedure is actually chosen is much less important than getting everybody to do it the same way!

Other issues, such as where (or if) a given function ought to be performed, are much more fundamental and reflect the different philosophies, objectives, and biases of the various designers. Some of these differences can be very deep, which is why the (often heated) discussions about them are commonly known as the Holy Protocol Wars. The mere existence of a controversy, however, usually indicates that no single approach is ideal in all situations, so it is very important to understand fully the pros and cons of each side.

As mentioned earlier, the current "packet switches" in our networks (i.e., digipeaters) are completely stateless, and this accounts for some of our problems (large packet headers, lack of hop-by-hop acknowledgments). So one question is: "How much state should be added to each packet switch to solve these problems?" To do hop-by-hop acknowledgments, for example, the switch will have to hold each packet in a buffer, retransmitting it if necessary until the next switch acknowledges it.

To eliminate the need for the user to specify the complete "source route" in each packet, the switch will need to maintain its own "routing table." Given the information carried in each packet, this table determines where the packet should be sent next. Should this routing table be based solely on destination addresses (thereby requiring the destination address to be carried in each packet), or should it also contain information about whatever end-to-end "connections" that might exist so that each packet need not carry the entire address? This is the crux of the famous "datagram vs. virtual circuit" argument. A virtual-circuit (also called "connection-oriented") network requires that each switch along the path be notified in advance of the transmission of data, so that a fixed route for the data can be set up. The CCITT protocols, such as X.25 and X.75, are generally in this class. In contrast, in a datagram ("connectionless") network, the intermediate packet switches handle each packet as a self-contained entity without regard to any end-to-end connections that might exist at a higher layer (generally at level 4, the Transport layer). The ARPA Internet Protocol is in this category.

Rather than delve more deeply into the issues (and risk cries of "foul" and "equal time" from the virtual-circuit advocates, since I'll admit to being the chief advocate of the datagram approach) I refer the interested reader to the papers published in the Fourth ARRL Computer Networking Conference.[9]

Routing and Addressing

Presently, AX.25 requires the user to specify a digipeater path to any non-local destination. Obviously it would be very desirable to automate this task, because it is at best tedious, and at worst impossible when the necessary information about a remote area isn't available. The "real" network towards which we are evolving will do this automatically, so the user will only have to give the destination address. Packet switches will determine their own routes to each destination and regularly exchange this information with other packet switches. In the worst case, each packet switch would have to maintain a complete list of every other station in the network along with the next hop to be used in reaching that station.

This is because amateur-radio callsigns (at least in the U.S.) do not give any definite indication of the station's location; a licensed amateur is free to move anywhere in the country while retaining the same callsign. This is an example of what is called "flat addressing," where addresses don't necessarily indicate anything about location within the network. Because the stations can move at will, flat addressing is clearly a great convenience to the user. The only requirement is that each address be unique, and the government already guarantees this to be true with amateur-radio callsigns.

(One clever way to allocate flat addresses in a non-amateur network without explicit central coordination is to use the serial numbers on paper money; tape a dollar bill to your computer and the government again guarantees you a unique number.) Flat addressing is just fine when everyone has a direct path to everybody else, since you don't have to keep a big routing table.

The alternative to flat addressing is hierarchical addressing, where the approximate location of each station is encoded in its address. An example of this is the telephone network; the area code locates the phone to a state or portion of a state, while the exchange generally narrows the area to a town or portion of a city. While less convenient to the user (you have to change your phone number when you move), hierarchical addressing clearly saves an enormous amount of routing table space. (With the cost of computer memory plummeting toward zero, though, it is not unthinkable that flat addressing even in the telephone network could become practical in the future.)

For the near future, however, it seems likely that some form of hierarchical addressing will be used in the new networks being designed. This means that the network will need more than just the callsign of the station you want to communicate with. Fortunately, the user need not be concerned with having to remember everyone else's network address. Special stations could be set up to provide "directory assistance" service, and this service can be checked automatically by the user's computer each time he wishes to communicate.

Transport Protocols

As mentioned earlier, there are two schools of thought on which "true" network (level 3) protocol ought to be used in amateur packet radio so that AX.25 could go back to being "just" a link-level protocol. It turns out that the internetworking protocols developed by ARPA (IP, based on datagrams) and CCITT (X.75, intended for the interconnection of Public Data Networks operated by different companies or countries, and based on interconnecting X.25 virtual circuits) are both possible bases for building an amateur network. (Consider a local rf "community" to be the subnetworks making up the amateur radio internetwork.) Both can operate on top of AX.25 level 2 as the subnetwork (local area) protocol, using it to provide the hop-by-hop acknowledgments which are generally considered necessary for performance reasons in amateur packet radio. (Other link-level protocols are also suitable for use under IP; see [10] for a detailed discussion.)

Most networks, datagram or virtual circuit, do a very good job of getting packets to their destination. No network, though, can guarantee absolute 100% reliability—just as the U.S. Postal Service can't guarantee that they'll *never* lose a letter. Recovering from these (hopefully rare) losses is the job of the Transport layer.

The Transport layer operates on an "end-to-end" basis. It detects when packets get "lost in the mail," taking action to make sure that the lost information is retransmitted. The Transport layer is relevant here because its design is heavily influenced by the services provided (or not provided) by the network.

The Transport (level 4) protocols used to provide flow control and error recovery on an end-to-end basis would be the ARPA Transmission Control Protocol (TCP) in the case of IP, or one of the simpler "X.224 Transport Classes" in the case of X.75. Here we see an example of a tradeoff in the network design: A datagram-based network has simpler packet switches than a virtual-circuit network, but requires a more complex transport protocol.

Development Status

Considerable progress has been made in the implementation of these protocols in the amateur service. At the 5th Amateur Radio Computer Networking Conference, sponsored by the ARRL at Orlando in March of 1986, the following demonstrations were given:

1. The ARPA protocols: IP (network); TCP and UDP (connection-oriented and connectionless transport protocols, respectively); Telnet, FTP, and SMTP (the presentation-layer protocols for remote login, file transfer, and mail transfer, respectively). I wrote these protocols in C and demonstrated them on a Xerox 820, although my code has also been ported to a variety of other processors. (The source code is available free of charge to anyone wanting to experiment with it for noncommercial applications; send me a blank 5.25" DSDD MS-DOS or 8" SSSD CP/M floppy with return SASE.)

2. A virtual-circuit network-level protocol based on a modified form of CCITT X.75. It was written in Z-80 assembler by Howie Goldstein N2WX and run on the TAPR TNC-2. Connections were established on an end-to-end basis, with hop-by-hop acknowledgments provided by the AX.25 link layer. Persons interested in experimenting with this software should contact Howie.

Conclusions

This is indeed an exciting time for amateur packet radio. Although this article was necessarily brief, I hope that you have gained some understanding of the considerable progress being made in the area of higher-level protocols. These developments will be an essential part of a unified network operating on a national and international scale that will be both more efficient and easier to use than the local-area networks that exist today. This will foster an even closer coupling between personal computers and radio communications. The ARRL sponsors activities to promote and coordinate the development of this technology, primarily through the Ad Hoc Committee on Digital Communications and the annual Amateur Radio Computer Networking Conferences.

The uses to which the amateur network will be put are limited only by our imaginations. The potential of this network for public service and disaster communications is clearly enormous. It will provide the opportunity for amateurs to gain inexpensive, hands-on experience with a technology very relevant to the non-amateur world. On the basis of these and other achievements, amateur packet-radio networking has done and will continue to do much to advance the Basis and Purpose of the Amateur Radio Service as stated in FCC Part 97.1.

The possibilities are limitless, so if you have an interest in contributing to this effort, by all means jump right in! One request, though: Please let the rest of us know what you're up to. Write papers and articles on your work whenever you feel you have something of interest. Some very interesting packet-radio developments have gone largely unnoticed because the people involved never thought it worth mentioning! ■

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Lightning Never Strikes

Ham radio vs. Mother Nature: Can you survive? Protect your investment—and your life—with these few simple precautions.

Since my article, "Defuse RFI," appeared in the October, 1983, issue, I've been bombarded by requests for more information on lightning protection and grounding in general, so here is some simple information that covers just about any grounding situation.

When Ben Franklin invented the lightning rod, it kept the barns from burning down, but Ben went to his grave wondering why no one had ever *seen* lightning strike one, even though he had solved the problem.

The reason is very simple: A lightning rod doesn't *attract* electrical atmospheric discharges, it establishes a constant electrical *drain* which, in effect, neutralizes an area of approximately 500 square yards. Therefore, lightning will strike a tree because the tree's resistance is higher than that of the ground (which has a very low resistive value).

Living where thunderstorms are born, I've had a lot of experience in protecting homes where the owners have lost TVs, stereos, microwave ovens, and even atrium water pumps. Usually I'm the last one called: The first recourse is usually to call a TV repair shop—getting a man to come out and survey the situation and give an estimate (usually over $1000) based on a lot of wrong approaches and a lack of fundamental knowledge (which unfortunately is typical). At this point the home-owner calls a consulting engineer (me), figuring it can't cost much more, and wants a second opinion. I quote about $200 for parts and labor and come out smelling like a rose money- and reference-wise. The following is a handy "instruction manual" on how to do it simply and correctly.

The first step is to drive a 6–8-foot ground rod next to the foundation of the building, where moisture is retained by capillary action. Don't use the "saddle" clamp that comes with the ground rod since it is subject to electrolysis and will loosen all by itself—go to an auto supply store and get a stainless-steel, worm-drive, universal fuel-hose clamp about ¼" larger than the diameter of the ground rod. Don't over-tighten this clamp as it strips out at about 6 psi; so good and tight is tight enough for the ground connection (it won't loosen). Waterproof with acrylic spray, silicone seal, or nail polish.

I then use a 10-foot section of TV steel mast, a 5-foot tripod, a trailer-hitch ball, and enough #8 wire to reach from one lag screw of the tripod mount to the ground rod. According to the U.S. electrical code, the wire does not need to be insulated, but no splices are permitted. The tripod mounting should be waterproofed with roofing tar or silicone seal. The ball is welded to the top of the mast section. The final step is simply to install a GE 120-volt MOV (metal-oxide varistor) on each side of the 220-volt drop to power company ground (the bare wire) in the fuse or breaker box, *after the fuse or breakers*, so the breaker will "pop" if the varistor shorts out. Turn the breakers *off* or remove the fuses when doing this.

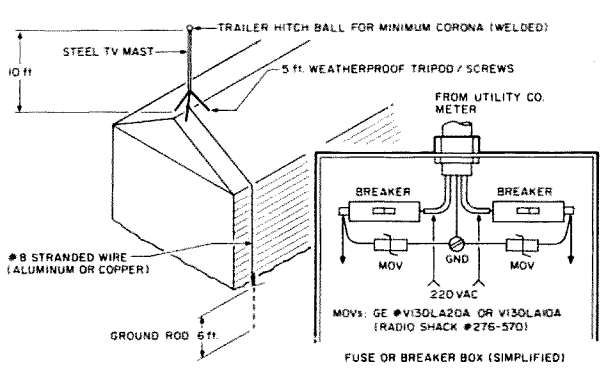


Fig. 1. Simple precautions to protect your home from lightning.

For a ham with a roof-mounted antenna, all that's necessary is to run the #8 wire from the mount to the ground rod as previously explained and add the MOVs. The coax should be broken, a PL-259 installed on each end (at the antenna mount), and a double-female coax lightning arrestor (Blitz Bug, etc.) installed at the splice and attached to the antenna mount with a stainless-steel, universal water-hose clamp (auto supply store). This must be waterproofed with high quality electrical tape (Scotch 33 or 88) or Coax-Seal putty. The same instructions apply to a tower, with the exception of an *additional* 6–8-foot ground rod installed at the tower's base. If the tower is 50 feet or less from the building, it's covered by the "drain effect" area (assuming a "non-isolated" antenna—otherwise it creates its own drain effect).

In one dramatic case, a home-owner sustained a direct hit on the utility pole and "pig" feeding his house that literally blew the pole out of the ground. After the power company crew replaced the pole and transformer, the person checked out every electrical device in the house and found he hadn't lost a light bulb! He called me and said to use him as a reference anytime (he's a pilot for United Airlines) and confessed he had had doubts as to the effectiveness of my work, but not anymore!

In summation, I well understand the nature of the human condition as to "What's in it for me?" outside of the obvious protection. Well, it's been my experience that a properly grounded station will enjoy a 1–2 S-unit improvement transmitting and receiving, a condition in itself that makes the job worth doing! ■

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And If That Wasn't Enough . . .

NK6K takes questions from the audience.

Most of the articles in this issue are tutorial in nature, rather than Question and Answer. Wishing to leave no stone unturned in the quest to get you interested in packet radio, we present: Packet Q & A.

The first envelope, please:

Q: What is packet radio?
A: Come on, you can do better than that. Unless you have been actively trying to avoid hearing anything about packet, you at least know that packet is a way of sending information over radio with computer assistance. The word "packet" is even appearing in the teeny-weeny print of the "section news" in *QST*. Packet is in use by all facets of the hobby, from the purely technical side (computer nerds) to the purely communications side (traffic handlers). The box you add to your station to do packet with is called a terminal node controller (TNC).
Q: Fine, but what's in it for me?
A: Now we're getting down to it, eh? If you are interested in computer networking, amateur packet radio is the perfect outlet for your creative talents. The packet technical scene is a vast open area of work waiting to be done.

If you are not a computer experimenter, but want to be well informed about amateur radio in general, packet-based information systems are sprouting up like weeds. On the local bulletin board systems (hold that question for later) here in Los Angeles, you can find the latest AMSAT bulletins and orbit predictions; the latest ham news from the *ARRL Letter*, the *W5YI Report*, and various other sources; the text of the latest FCC notices; and, of course, news from the world of packet. Other areas carry any of several DX bulletins and propagation forecasts. International newsletters are starting to become more common as links overseas are established.

Packet can also be used to just chat with others.



Photo A. The N6BGW-9 BBS, running semi-unattended on 146.745 MHz.

Q: What is a bulletin board system?
A: As the name implies, a bulletin board system (BBS) is a place to store bulletins so that others can read them. A BBS consists of a computer that has space to store messages and files and a program that allows hams to leave and retrieve them. The messages may be of general interest (like getting a propagation forecast or asking for a loan of a wattmeter) or they may be specific (like confirming an 80-meter schedule).
Q: You sound as if packet is the only mode that has that stuff. Aren't there RTTY-based bulletin board systems?
A: Yes there are, but BBS use has become widespread with packet. The first reason is that packet is faster. On two meters, packet is running at about 1,440 wpm, as opposed to 100 wpm maximum for Baudot-RTTY. In numbers that mean something, on two meters it would take about 26 minutes to send the latest AMSAT news at 100 wpm Baudot and about 2.5 minutes using packet. It would take 52 minutes to transmit the *ARRL Letter* on RTTY and five minutes on packet. Because of this, not many people would consider putting a large newsletter on a RTTY mailbox—there wouldn't be enough time in the day for 20 or more people to read it.

The second reason is that packet shares the channel. Due to the way packet works (and you can ask that later), several people can use the same frequency at the same time. Thus, while someone is chatting about the weather, someone else can be reading a propagation forecast. Although both acts will take a little longer if the frequency is shared, at least one party isn't gritting his teeth, waiting for the seventh person that day to read the same message before he can chat.

The final reason is that packet detects any errors that occur during transmission and corrects them by "asking for fills." Thus, it now becomes possible to reliably download files where a small error can cause big problems, like files containing orbit predictions or a file listing the times when the Heard Island

DXpedition will be on 80 CW. If you get a wrong number, you'll be wondering why the band is so quiet.

Q: I get my news by listening to Bud replay the *Westlink* tape on the local repeater. Why should I invest in new gear?

A: A bulletin board system is there when you are. If you want to get your news from Bud, you have to be there when Bud is holding forth on the repeater. If you get moved to the night shift at work, there goes your news. A BBS (a non-real-time system) frees you from the clock and Bud's schedule. You can even talk to Bud on the BBS or leave him messages that he can read when he's available, and Bud can store messages for you when you're not.

Q: All this is fine, but I'm a HAM, not a news hawk. If I want news I'll watch cable. What good is packet to real hams and not computer nerds?

A: In addition to the above types of activity, packet is used by hams who simply want to chat, just as on RTTY, AMTOR, and CW.

Q: But what do you talk about?

A: Anything of mutual interest or even of unilateral interest. Packet just moves the characters; what you put in is up to you.

Q: My buddy told me packet is only one-on-one, that you can't have a round-table discussion.

A: You can have a round-table discussion on packet, either one-to-many or many-to-many. These work best when everyone can hear everyone else, either directly or through a duplex repeater. Every Monday night in the Los Angeles area, at 9 p.m. on the N6GPP repeater (146.145 in/146.745 out), a packet round table is held. One occurred last night while I was writing this.

The way it works is everyone connects up in pairs and sets the packet equipment up so that other conversations are also displayed. Everyone can now see everyone else. Because N6GPP is a digital duplex repeater (described later), any packet sent by you that is heard by your connect partner will be heard by everyone else. Any packet missed by everyone else will also have been missed by your partner, and your TNC will resend it.

In the net last night, there were 30 people checked in. In the time the major portion of the net occurred—from 9 p.m. to 11:30 p.m.—69,000 characters were sent. This is a count of characters actually typed by someone, and does not include retransmissions or callsigns. That comes out to about 460 characters per minute, or 92 wpm. That doesn't mean that there were any 92-wpm typists on the net; 30 people typing at 3 wpm would have the same effect.

Q: What do you talk about in a packet round table.

A: Anything you want. Topics discussed on last night's net included: The Stoner proposal for a Public Digital Radio Service; AMSAT's upcoming Phase-3C launch; no code, with support for and against; the number of repeaters in England; hard disk problems with a local mailbox; tightrope-walking pigs (don't ask me why); how to get more people interested in amateur radio; open versus closed repeaters on 70 cm; autopatches, good or bad; compact digital audio discs and the music on them; Captain Midnight of HBO fame; and a lot of miscellaneous background chatter.

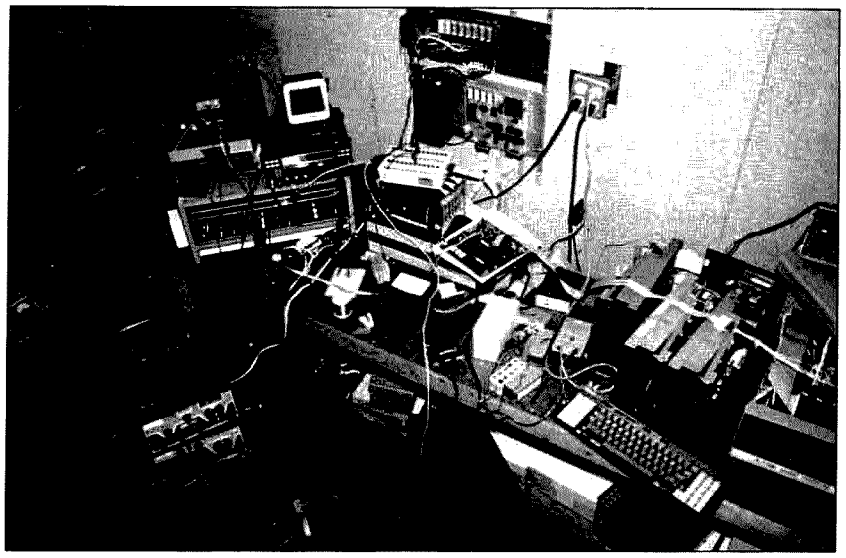


Photo B. This station is equipped for packet use on HF, VHF, UHF, and OSCAR 10. See text.

In general, you talk about the same things anyone talks about on a ham net.

Q: Real hams don't use nets. Can I call CQ?

A: Yes. You can direct your CQ into distant areas by using packet repeaters called digipeaters, and you can include text with the CQ—for example, "CQ anyone who wants to talk about fly fishing." You can also set your TNC up so that it displays only packets sent by people calling CQ. In fact, you can set up some TNCs to not display packets from certain people, so if someone is sending data you don't want to see, you don't have to see it. There is *no* truth to the rumor that TNCs come from the factory trained to ignore packets containing editorials from W2NSD/1.

Q: Speaking of callsigns with "/" characters in them, my TNC won't let me use my full call, G4JPZ/W6. Why not?

A: The number of characters devoted to storing the callsign of packet stations was a Big Issue in ye olden days. The call is sent in every packet, and the fewer characters of overhead, the better. The number agreed on was six, as this would contain all the characters needed to uniquely identify a station using the call assigned by its home government.

Q: What does the number in packet callsigns like WB6YMH-2 mean?

A: Each TNC must have a unique identifier. Because a ham can own more than one TNC, just as he can own more than one radio, it is necessary to have a way to distinguish the various TNCs owned by WB6YMH. The number, called a secondary station identifier (SSID), is used for that purpose. SSIDs run from 0 to 15; 0 is assumed if no number is stated. There have been various schemes purposed to "band plan" the numbers—e.g., 0 is your personal station, 1 is your first digipeater, 7 is your satellite gateway, etc.—but none of them have yet caught on. There are too many types of stations and not enough numbers.

Q: Is packet used for public service?

A: I'll give you an example. Pittsburgh, Pennsylvania, recently had a marathon, and as usual hams supplied public-service communications. Packet was used to move information on downed runners from out on the course to the finish line, where family and friends waited. A packet base station was set up at the end of the course, consisting of a Compaq computer running a data-capture program, a TNC-1, and a printer. A battery-powered mobile packet station was placed in a truck that drove along the course. This station, made up of a Data General 1 laptop computer and a TNC-2, stopped at 15 aid stations, gathering names and dispositions for relay to the finish line. The names were typed on a keyboard only once; after they were transferred via packet to the base station, they were printed by the computer and posted in the reunion area. Two digipeaters were used at different points along the 26-mile course: W3VC and WA3YOA-3. N3CVL and W3MC ran the base station; WA3HGW was in the truck.

Q: I hear a lot of different names for repeaters in the packet world. Why are there so many kinds, and what's wrong with using just a regular repeater?

A: The major types of repeaters you'll hear about are voice repeater, digipeater, dual-port digipeater, and digital duplex repeater. We'll take them one at a time.

The term **voice repeater** refers to the traditional repeater commonly found in the two-meter band. In most such repeaters, the audio output from a receiver is passed more or less directly to the audio input of a transmitter. Any FM signal heard by the receiver is sent out of the transmitter. It is therefore possible to send packets through a "voice" repeater. It is inadvisable to do so, however, on any repeater in which the user support communi-

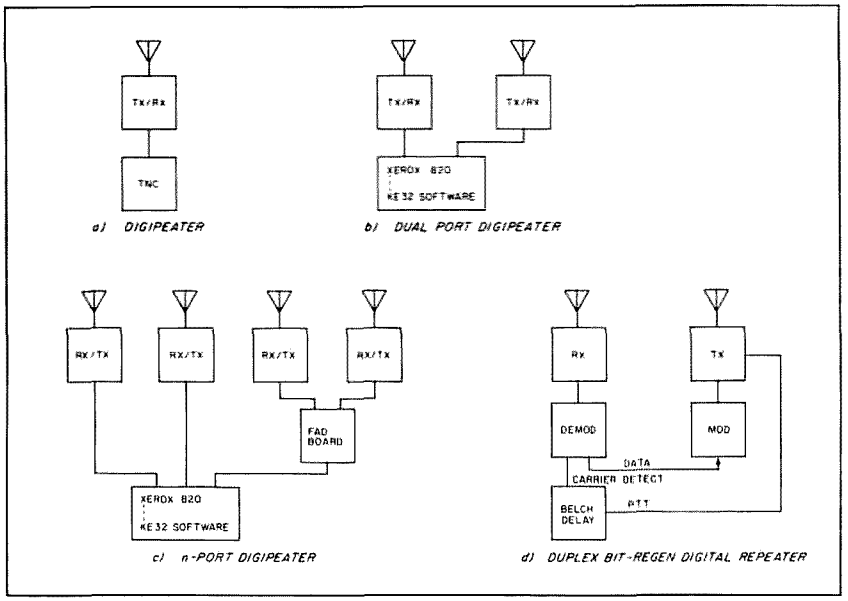


Fig. 1. Packet repeater configurations.

ty is not interested in such activity. Nothing is more certain to bring the villagers up the winding path to your castle's digital laboratory with torches and flaming pitch than pumping "braaaaap" through the local voice repeater during the nightly bull session.

By "user support community," I mean those individuals who make up the repeater group and support the repeater with time, talent, or other resources to keep it running. Cretins who think the repeater is a public utility can be ignored as always. There are plenty of other frequencies around, so stay away from the "No Digital" voice repeaters, and we'll hope they stay away from the 145.0 through 145.1 digital area. Fortunately, only a few of the misguided individuals in the "My license says I can transmit anywhere Part 97 says I can" group have found their way into packet.

A **digipeater** is a digital-only device. As shown in Fig. 1(a), it is the simplest of all packet devices, consisting of a TNC and a transceiver. A terminal is used initially to set the TNC's parameters, but it is not required for operation. A digipeater is a simplex repeater. It listens for packets on a frequency, checks them for accuracy, and then retransmits them on the same frequency. Any packet station can serve as a digipeater. Stations intended for remote or mountaintop service are usually "hardened" (see "Survival Training For Mountaintop Digipeaters" in this issue).

```
---------  To:NK6K De:WA9FMQ Re:HF Message Returned
|
|  ------  Msg# TR  Size  To     From    @ BBS  Date     Title
|  |        4197  Y  1116  WA9FMQ NK6K    W3IWI  860522 Message from UO-11 DCE
|  |       Via WB2RVX: 5118 From NK6K Rcvd 860522/1007z, Sent 860522/1515z
|  |       Via WA2SNA-1: 5171 From NK6K Rcvd 860522/0923z, Sent 860522/1001z
|  |       @ W2JUP :  1189 NK6K    R-860521/2147 S-860522/0522 EDT
|  |       @ N2IH  : NK6K      536 R-860521/0941  S-860521/2151
|  |       Via W1AU: 6251 From NK6K Rcvd 860521/1228, Sent 860521/1338
|  |       At WB1DZK:   543 From NK6K   Rcvd 860520/1229, Sent 860520/1626
|  |       Via N1DKF: 6318 From NK6K Rcvd 860521/0722z, Sent 860521/0828z
|  |       Via K1UGM: 1461 From NK6K Rcvd 860521/0257z, Sent 860521/0723z
|  |       Via W0RLI: 514 From NK6K Rcvd 860521/0249z, Sent 860521/0255z
|  |       Via W0RLI: 1015 From NK6K Rcvd 860521/0248z, Sent 860521/0248z
A |       Via KD6SQ: 38 From NK6K Rcvd 860520/1842z, Sent 860521/0247z
|  |  ---  At NK6K  :    82 From NK6K   Rcvd 860520/1134, Sent 860520/1139
|  |       Gary,
|  B       Here's your message routed from the DCE back to you.  I downlinked
|          it around 18:00 utc May 20.  Please send this message back on the
|  |  C    DCE so I can get the forwarding times.  Thanks, Harold.
|  |
|  |  | -- To: NK6K, CO/K8KA  De: WA9FMQ  Re: Demo
|  |  |  |
|  |  |  D  This is a demo of UoSat-2 to Mr. James Muney , Washington rep
|  |  |  |  of the Space Studies Institute, Arlington, VA.
|  |  |  |
|  |  |  |  73, Gary
-----------
```

Fig. 2. The mail-forwarding network in action. D) The original message sent on Uo-11. C) That message as sent eastward from Los Angeles. B) The message as it arrived in Washington DC. Each BBS that forwarded it has placed an ID stamp in the message. A) The received message as sent to Los Angeles again on Uo-11.

Digipeaters can be "linked" in chains of two or more on a packet-by-packet basis. The callsigns of digipeaters can be placed in a packet along with the source and destination stations. Each digipeater repeats the packet in turn, which can send the packet hundreds of miles. Although this scheme does have its limits, digipeating allows simple linking without requiring multiple radios and antennas at the digipeater site.

A **dual-port digipeater**, shown in Fig. 1(b), is a more complex version of the standard digipeater. It was first developed by Jon Bloom KE3Z and others at the ARRL lab in Newington, Connecticut. A dual-port digipeater can digipeat packets on two radios at the same time. Although this is more complex in terms of rf, the advantage is that two frequencies can easily be linked together. Packets received on one frequency can be repeated on the same frequency or on another one by the other radio. Which frequency is used is controlled by tables in the digipeater's software. Aside from linking packet communities on two frequencies, the dual-port digipeater can be used to move packets off of a heavily used local frequency and onto a "backbone" frequency.

For example, suppose that most of the packet users on the East Coast were on 145.01 MHz. If you try to use a string of four standard digipeaters on 145.01 to connect to someone 300 miles away, you would have to contend with all the other users of 145.01 throughout the 300-mile range. Obviously, if 50 people are trying to share a single frequency equally, the most you'll get for yourself is 1/50, which isn't much. Now let's assume that there is a dual-port digipeater at both ends of the chain, one where you are and one 300 miles away. You transmit your packet on 145.01, and it is retransmitted on a second frequency, perhaps 220.95 MHz. Your packet could then go down a string of standard digipeaters on 220.95 until it gets to the end, where it would be repeated back onto 145.01. The advantage is that you've bypassed all the local traffic on 145.01 between the two ends. A "backbone" is just like an interstate highway. If access is limited to occasional on-ramps, it can be used to bypass business districts.

An **n-port digipeater** is just a bigger dual-port digipeater. As shown in Fig. 1(c), you can add as many ports (places to stick radios) as the hardware will bear. The original dual-port code was first implemented on a Xerox 820, which had two ports. A device called a FAD board, designed by the FADCA group in Florida and available from TAPR, extended that capability to four ports. Contact KE3Z at the ARRL if you want a copy of the software.

A **digital duplex repeater** is much like a voice repeater except that bits are passed between the receiver and transmitter rather than audio. Fig. 1(d) shows such a device. Audio from the receiver is passed to a demodulator. Data from the demodulator is passed first to a modulator and then to the transmitter, which is transmitting on a frequency other than the receive frequency.



Photo C. Is I/O The Dog (NK6K-4) burying the CW key...

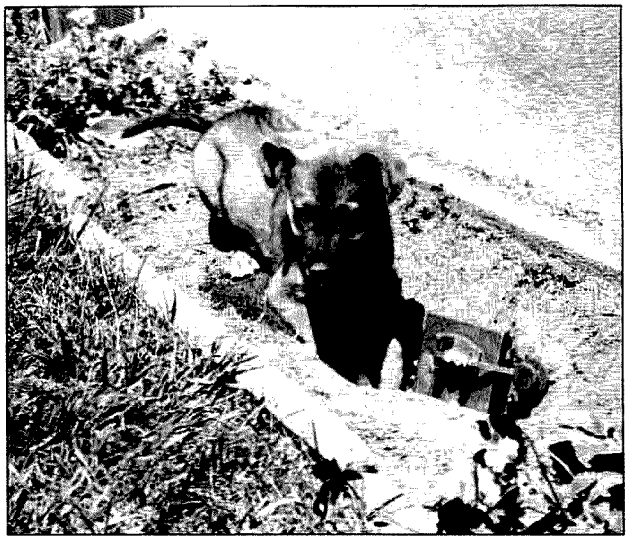


Photo D.... or is he resurrecting it?

The advantage of this over an audio repeater is that each bit starts fresh at the transmitter. The output audio can be more closely controlled. The advantage over a digipeater is speed; the packet is retransmitted as it is received, rather than being repeated after it has been completely received and checked. Another advantage is that, except in fringe areas, each station listening to the output of the repeater will hear exactly what every other station is hearing. If one station correctly received a packet, chances are good that all other stations in range of the repeater heard it as well. This makes packet round-table sessions much easier to hold.

The disadvantage over digipeaters is that a duplex repeater will retransmit a damaged packet (one that is weak at the receiver or that has suffered a packet collision) when two packets from different stations start at the same time. Duplex repeaters cannot be linked as simply as simplex repeaters, since a second pair of frequencies must be used. The N6GPP digital duplex repeater in southern California avoids this problem by being a hybrid. It is also a dual-port digipeater; one port is connected to a simplex frequency, the other to the duplex repeater. Packets received via the duplex input can be digipeated out on the third frequency and vice versa.

Q: I also hear about things like bulletin boards, mailboxes, file servers, and hosts. Are they the same or different?

A: These names all refer to basically the same thing: a computer attached to a TNC, performing a central service for other packet users. They all look the same at the hardware level; each is a personal computer and has a certain amount of disk space. The different names specify the type of service offered by the system. The names are not standardized, and there is some overlap.

A **mailbox** implies that only a mail storage service is provided. Messages, usually limited in length by software or convention, can be stored. They can be addressed to individuals or groups. A facility usually exists to retrieve messages based on whom they are sent to or who sent them. Each message has a title tagged to it, which can be displayed as a quick summary of the contents of the mailbox.

A **file server** stores only files. The files can contain messages, but a file server does not have fancy retrieval methods. Files are stored by name and retrieved by name; they do not have addresses. Files can be any size, and usually contain long reports, newsletters, digipeater maps, etc.

A bulletin board system is a combination of a mailbox and a file server. It has a mailbox facility as well as a place to store large files. This is the most common system found. Messages can be placed in the mailbox that describe the contents of files placed in the file area.

A **host** system is potentially the most powerful system of all. In all of the above systems, a program is running that "talks" to the user and provides the various services. In a host system, the user is talking directly to the computer's operating system, just as if he were at the local keyboard. He can run a variety of programs, including a mailbox program if one is available. One common program found on amateur packet hosts is a satellite orbit prediction program for tracking OSCAR satellites. Games are also common. Any computer can be used; I have seen both UNIX and CP/M systems running on packet.

There are many different software packages available to implement all of the above types of network service packet stations on almost any computer. All of them have been written by hams or adapted from other sources by hams. Software exists for Commodore 64, Apple, generic CP/M, generic MS-DOS, TRS-80 (all models including the 100), UNIX, and at least one Data General Mini. The quickest way to get on the trail of this software is to leave a message to the sysop of your local BBS. Another good place is "So You Want To Be A Sysop" in this issue. Several photos of packet BBS systems are scattered throughout this issue as well.

Q: Is unattended operation of packet stations legal?

A: Yes. The FCC recently issued a Report and Order on PR docket 85-105 which made several changes to the rules explicitly permitting such operation. One example:

Section 97.69 on digital communications is amended by adding a new paragraph (d), as follows: An amateur station may be under automatic control when transmitting digital communications on frequencies 50 MHz and above.

Other sections were added defining automatic control, and requiring that devices and procedures be used to ensure compliance with the rules. A controversial section that did not permit automatic control while transmitting third-party traffic was temporarily waived, pending review. The point of contention is too complex to treat well here, but basically has to do with the traditional definition of third party as communications that do not occur on behalf of the control operator. Since most of the traffic flowing on the path between Boston and New York has little to do with the control operator of a digipeater on that path, that digipeater would not have been permitted to run unattended. The packet world prefers to see third-party traffic defined as communications where one of the parties is not an amateur. Traffic originated by amateurs and destined for amateurs would not be third party, and would be permitted in all cases.

The other point packeteers made with the FCC on this topic was that once "real" third-party traffic (i.e., from a non-ham) was entered by a ham into the network, it need not be considered third party while in the network. The amateur who started it on its way has already made sure it complies with the rules. As I said above, the no-third-party provision was waived, pending review. The FCC asked that packet stations be vigilant, and be on the lookout for abuses and non-amateur use of the network.

Photo A shows a mailbox system running in the unattended mode. Hefner fans, can you spot the Bunny?

A final comment. The term "automatic control" as used in the FCC rules means that the station is unattended. When packet people talk about an automated station, it sometimes means that the actual mechanics of message relaying is automatic and that an operator is still present and is "at the control point." Thus, if you hear someone talking about automatic relay of messages on an HF station (below 50 MHz), it isn't necessarily illegal, so long as someone is actually at the control point. Unattended operation of an HF transmitter, automatically relaying messages or not, is not permitted under the current rules.

Q: All of the pictures of ham shacks in this issue look staged. Everything is too clean.

A: Well, maybe folks did clean up a bit before the photos were taken. Therefore, in the interest of truth in advertising, we present Photo B. This is from the old days of packet, when bearded experimenters toiled in basements (East Coast) or garages (West Coast), and nothing was in cabinets. To see if you qualify as a packet pioneer, try to spot the TNCs in this picture. There are two of them in clear view. This shack belongs to WA6JPR, who started up packet in the Los Angeles area back in 1981. The photo is from late 1983.

Q: I've heard both good and bad things about packet on the HF bands: stories about automatic cross-country message forwarding with coast-to-coast relay 24 hours a day, and also that HF packet is "unusable." Who's telling the truth?

A: Both have elements of truth.

Fig. 2 shows the amateur packet network in full swing, and is a look at things to come. It shows a message that was sent from the East Coast to the West Coast on the UoSAT-OSCAR-11 (Uo-11) satellite's digital mailbox, then was sent back to the East Coast using the forwarding BBS network, and then sent back to the West Coast using Uo-11 again.

The Uo-11 system is briefly described in "Birds 'N' Bauds" in this issue; forwarding BBS systems are mentioned in "So You Want To Be A Sysop." In the forwarding BBS system, the message is automatically passed from one mailbox to another, using direct VHF paths, strings of digipeaters, or HF. Each system adds a line to the front of the message when it is passed on. Although one of the systems has its clock set wrong, and some use UTC while others use local time, you can see how long the message took as it passed from place to place.

The path the message takes is not necessarily fixed; HF propagation and VHF equipment outages affect the path from hour to hour and day to day. Each system tries to pass the message closer to its destination using the best path available.

Today, this system can take longer than the human-directed CW/phone NTS system to deliver a message. On the other hand, the NTS system is more labor intensive, requiring humans to copy the messages by hand. As the packet network gets "smarter," messages will travel through the most optimum path. The NTS system is already taking advantage of packet systems in those situations where they offer the best or additional service. Traditional NTS networks are used where they offer the best service.

But we've moved away from the question slightly. The above discussion shows that the packet network is functioning. But is HF packet the panacea that some claim it to be?

Packet offers "perfect copy," where perfect is 99.999% plus a harder-to-quantify number of more nines to the right of the decimal point. (See the June NK6K > Packet column for a further discussion.) Packet does this by repeating a packet until it is received perfectly. The problem is that on a noisy HF channel, perfect can be a long time coming. Take a look at the following line of text as it might be received by an RTTY station on a noisy 20-meter frequency:

THE QICK BR WN FOXSJUMQS OVE
?FD. DOGS BACK

A human operator can make a pretty good guess that it was transmitted as "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK." Even though the message was only 69% correct, the information was passed. On packet, the message would have been rejected, and no information would have been passed. Score one for RTTY.

Now let's look at the following line of text, received by an HF RTTY BBS system:

TYPE ORBITS144

Can you tell that this was sent as "TYPE ORBITS134"? No, and neither can the BBS system, which proceeds to send you 15 minutes of last week's orbital elements. The packet system 20 kHz up the band took three tries to get the line through, but now it's reading this week's elements. Score one for packet.

We're off the path again. The question was "Is HF packet really usable?" It comes down to two things: hardware and user training. The RTTY community has spent many years perfecting terminal units (TUs) that can reach down into the noise and pull out signals. The packet community, flushed with the success of the "cheap and easy" Bell 202 modems used on two-meter FM, started out in HF using another "cheap and easy" source of modems, the Bell 103 standard.

This standard grew in packetdom for the same reason the Bell 202 standard did. The first person who promoted HF packet had a ready supply of Bell 103 modems, and he made some available to friends. Thus, first HF users were on a 200-Hz shift, and each new user after that used the same standard. The simple modems on the kit TNCs and the later TNCs based on them were retuned for 200 Hz and pressed into HF service. The reduced-parts-count TNCs used a telephone modem chip with the same standard and, presto, an HF modem. All of these modems are less than optimum and miss some bits. Any time a packet must be repeated, the frequency becomes more crowded. More crowding leads to more bad packets and to more crowding.

A close look at the modems on TAPR-style TNCs was done over the last winter to try to improve HF performance. The changes published give an improvement, primarily a reduced requirement for precise tuning. More importantly, some manufacturers are addressing the problem by making real HF modems available that are designed like HF TUs and not like telephone modems, for example the AEA PM-1. Hams are also beginning to modify RTTY TUs and use them for packet. You can either buy a $1,000 linear amplifier for your station or a $150 modem for the station you're trying to talk to. As more serious HF users upgrade their modem capability, you'll notice that your station seems to get out better.

I also mentioned user training as a factor in HF viability. There are upwards of 70 parameters on a TNC. As shipped, most of the defaults are correct for VHF use. Many are dead wrong for HF use. The parameters that will have the most effect are the packet length and the retry timer (FRACK). Experiment with these values for the best performance on HF.

One final thought on this facet of HF operating. There are many forwarding BBS systems present on HF. Most of them are on 14.107 MHz. These systems pass cross-country traffic funneled through from the larger number of VHF BBS systems and thereby benefit a large number of hams. If you connect to these systems on 14.107 or carry on a non-BBS QSO on that frequency, the forwarding systems can't forward. These stations must congregate on a single channel to forward the mail, but individuals are free to roam. Please do so. If you have another way to access the national forwarding system, like a local VHF BBS, please use it instead. If you do see an interesting DX station working a BBS to get news he can't get another way, once you contact him move off to another frequency. If this sounds like the concept of a calling frequency, it is. The more things change, the more they stay the same.

Q: How is DX on packet?

A: I knew you'd ask that, so I forwarded some messages to various VHF and HF BBS stations asking for DX information. In less than a week I received four responses back through the forwarding system. Complied from lists supplied by W0RLI, WD4BIW, W9ZRX, and N1DL, and a letter to WB9FLW from DU1POL, here is a list of countries with known HF packet activity: 5H3, 5V, 9K2, 9M, CN8, DL, DU, EA, F, G, GW, HB, HK, I, JA, KH6, KL7, KP4, LA, OH, ON, OX, PA, PJ, PY, SM, TI, VE, VK, W, XE, YB, ZF1, ZL, ZS.

There are probably more reports on the way, and there are new countries coming online every month.

Q: Will CW be replaced by packet, never to be heard from again?

A: Of course not. On the other hand, see Photos C and D.

Class dismissed. ■

Harold Price NK6K
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Redondo Beach CA 90278

On The Shelf

Most amateur packet bibliographies I've seen recently are endless lists of books and articles. In this one, I'll mention only a few, but I'll tell you why you might want to take the trouble to look them up. Most of these references contain bibliographies of their own, so you should have no lack of sources with a little effort.

Introductory Material

H. Price, "What's All This Racket About Packet," *QST*, July, 1985.

H. Price, "Packet Radio—A Closer Look," *QST*, August, 1985.

These are basic introductions to packet articles. The second article uses the TNC-2 to describe what's in a TNC.

J. Grubbs, *Get *** CONNECTED to Packet Radio*, Qsky, 1986.

This is the first book published that addresses the operational aspects of amateur packet radio as practiced in 1985-1986. It takes you from picking out a TNC up through your first connect and briefly touches on many other topics. This is the first of what will be an avalanche of "how to use it" rather than "how it works" books. This is certainly a niche that needs to be filled. While intending to keep the material basic, the author includes an extensive list of references for further study if a topic catches your fancy. A list of packet organizations and equipment suppliers is also included.

Several other slightly more technical introductory articles have been written. They are a bit dated now as most of them refer to the TNC-1-style TNC, but much of the information is still valid. They are:

M. Morrison, D. Morrison, and L. Johnson, "Amateur Packet Radio Part 1 and Part 2," *Ham Radio*, July and August, 1983.

L. Johnson, "Join the Packet Radio Revolution Parts 1, 2, and 3," *73*, September, 1983; October, 1983; January, 1984.

And one piece from the history section:

D. Borden and P. Rinaldo, "The Making of an Amateur Packet-Radio Network," *QST*, October, 1981.

This was my and many other's first exposure to coordinated amateur packet activity. In 1981, many groups were working on digital experimentation, but not all groups knew about each other. I can remember the first time I read it, lying in bed after midnight leafing through that month's *QST*. I also remember very clearly thinking that amateurs would never agree on a standard to the level necessary to build a North American network. This article is interesting now mainly for its historical value, and it includes a list of other articles of historical interest.

Technical

A. Tanenbaum, *Computer Networks*, Prentice-Hall, 1981.

You used to be able to tell the true amateur packet pioneers because they had a copy of this textbook on their shelves. It was almost required reading back in the pre-boom days, and you found out about it through word of mouth. TAPR included it in the bibliography in the manual for the TNC-1, and its fame in amateur circles grew. Back then you had to special-order one or live near a university book store. Last month I came across a stack of them in a local ham radio store. This is a real textbook; I paid $30 for mine. It gives a very readable overview of the field of computer networking. If you want an understanding of the basic technical issues of packet radio and where our network fits into the world of networks in general, buy or borrow a copy of this book.

The 1986 ARRL *Handbook*.

The *Handbook* underwent a major upgrade in 1985, and 1986 adds even more pages on digital topics. If you've been buying a handbook every 15 years or so, which used to be often enough, break your cycle and buy one this year. I can't say enough good things about it, even about the non-digital sections.

Packet radio is discussed on pages 19-23 to 19-50, and various related topics are scattered around the book.

Terry L. Fox, *AX.25 Amateur Packet-Radio Link-Layer Protocol*, ARRL, 1984.

This is a must read for people who want to write their own AX.25 code, or who want to know how AX.25 really works. AX.25 represents the most exacting set of specifications amateurs have ever lived by, at least until the networking protocols are agreed on. This book documents the outcome of various mandates, agreements, negotiated settlements, and faits accomplis that make up any protocol. It is written in standard protocolese, which makes for dry reading. This book is not for the weak of heart, and it won't tell you how to operate a packet station.

The ARRL Amateur Radio Computer Networking Conferences

The development of packet radio is the best documented effort in amateur radio history. The most obvious reason is that nearly all of the correspondence between developers was done using computers and electronic mail. These are easy to save and easy to expand into a technical paper. The papers are then easy to print and publish. The ARRL has sponsored, along with various technical groups, a series of computer networking conferences. In addition to serving as a common meeting place for in-person talks, it is also a good deadline to work against for getting your thoughts down in writing and getting them in the public eye. There have been five such conferences since 1981, the most recent one in Orlando in March, 1986. The papers presented there are published, with no editing, by the ARRL. Conferences 1–4 are now available in a single volume; the 5th conference is available separately. Along with volumes 1–4, you get all of the issues of the *Gateway* newsletter from August, 1984 through September, 1985, which document a lot of packet doings on their own.

Altogether, there are more than 600 pages of information, more than 100 articles, and 40 authors. Read these, and come to the 6th conference, which will probably be held on the West Coast. One warning: Not all of the implementation plans you'll read here ever made it past the paper stage.

Amateur Packet Radio in Non-Ham Publications

I include this section because I'm concerned about the long-term viability of the Amateur Radio Service in view of the frightening statistics that the average age of a ham is increasing one year per year, and that 0% of the respondents to the Fun! poll this year were in the 16–21 year age bracket. Packet radio is one of the more interesting things we can use as a hook to get new people into the service. Here are some non-ham publications where amateur packet has appeared. It may be easier to get a friend to read a copy of *Byte* than it would be to start him out with a magazine whose cover features an older gentleman in a suit and tee-shirt talking into a small box. At least initially anyway.

P. Karn, H. Price, and R. Diersing, "Packet Radio in the Amateur Service," *IEEE Journal on Selected Areas in Communications*, May, 1985.

J. Markoff, "Bulletin Boards in Space," *Byte*, May, 1984.

J. Markoff, "Satellite Promises Low-Cost Communications," *Infoworld*, January 23, 1984.

H. Price, "PACSAT," *Personal Communications*, September, 1985.

G. Zorpette, "The High-Tech Hobbyhorse," *IEEE Spectrum*, May, 1985.■

Perry Donham KW1O
73 Staff

Kit Corner: The DSE 500-MHz Frequency/Period Counter

Looking for an inexpensive 500-MHz frequency counter? If you're willing to spend a few hours with a soldering iron, you can put together the Dick Smith Electronics kit #K-3439 for about $90. Accuracy is on the order of ±50 Hz for most measurements, which is close enough for almost every application.

The unit is built around a single-chip frequency counter, the 7216B, which includes an oscillator, data counters, and display decoders and multiplexers. The basic instrument will measure frequencies up to 50 MHz; an optional prescaler kit (#K-3432, $23) extends the range to 500 MHz.

In addition to measuring frequency, the unit also can be set up to display the period of a signal for between one and one thousand input cycles. This method is a bit more precise (though not more accurate) than the standard frequency-display mode.

Appearance

The plastic front panel is silk-screened and pre-cut. Insulated BNC connectors are provided for the input jacks. Seven large, easy-to-read LEDs make up the display, which sits behind a red plastic filter.

The case is a plastic four-piece affair, and that has been designed to accommodate a wide variety of circuit boards. There are about thirty mounting posts in the bottom of the case; you only need four of them. The rest must be cut away or ground down, which I thought was a bit of a nuisance. It took me about three passes with a grinder to get the board to sit properly.

Construction

Warning: This is *not* a hold-you-by-the-hand kind of kit! If you are spoiled by Heathkit-style manuals which advise you to "place R20 (red-black-brown) in position C after carefully bending the leads," you will be catatonic after reading, "Now mount the resistors and capacitors." I found that grabbing parts out of a giant pile and matching them to the schematic was really fun! It made me feel like I was really building something, rather than just mimicking someone else.

There were a few snags. The worst was caused by the parts-placement diagram in the manual—the parts were there, but the circuit pattern under them was missing. Most of the time it was easy to guess where a part went, but in several instances I had to put the board behind the diagram and hold it up to the light. Also, the instructions for wiring the ac transformer are a bit vague, and I had to resort to tracing leads on the PC board to decide where the wires from the secondary were to go.

Take care to read *all* of the notes that surround the placement diagram—I didn't, and ended up unsoldering a few parts that I'd put in the wrong places.

I was disappointed to find that no sockets were provided for the ICs. The manual states that "sockets may be purchased." This is inexcusable—I can't believe that three or four sockets would raise the price of the kit more than a dollar or two. It just doesn't make any sense not to socket ICs.

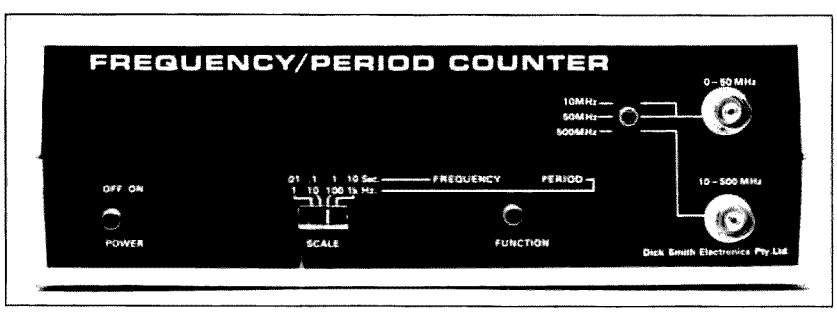


Photo A. DSE's inexpensive frequency/period counter.

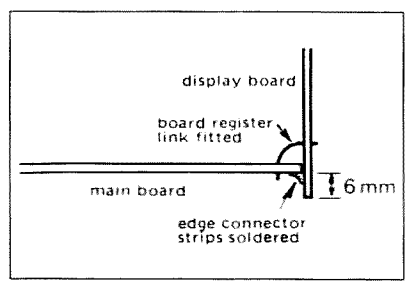


Fig. 1. You're instructed to join two circuit boards with solder fillets.

Another disappointment was the method used to mount the display. The frequency counter uses a main board for the counter and input circuitry, and a display board which holds the LEDs and switches. All of the wiring to the LEDs and switches is accomplished with PC traces; the traces on the main board mate with those on the display board. This is great for cutting down on the number of connections, but to join the two boards, the instructions ask you to use solder fillets (Fig. 1.) This may work if the boards fit perfectly together, but in my kit there was a gap of about 1/4" to fill!

At first I thought, "Well, they must know what they are doing," and I actually attempted to hook the boards together with solder bridges. I ended up ripping two solder pads completely off of the board.

I finally gathered a few dozen of the resistor leads that were scattered about my desk and formed them into connecting fingers. This worked really well; the leads were flexible enough to let me bend them around to get the boards to fit into the case. And I didn't have to worry about solder bridges forming the only electrical connection to the display board.

Apart from the problems I've already mentioned, I thought that the construction manual was fairly well done. Quite a bit of space is devoted to explaining the circuit in minute detail. Unfortunately, the manual was intended for an Australian audience, so you have to put up with power cords having blue, green, and brown wires, and with color-burst oscillators running at 4.433619 MHz. The wording in some cases is difficult to understand, but a careful re-read will clear things up in most instances.

Operation

With the counter tucked neatly into its case, I switched on the power and was pleasantly surprised not to see wisps of smoke. I don't have a signal generator, so I checked the clocks in all of my computers, the output of all of my rigs, and so on. An oscillator I built around a TV color-burst crystal was off only a Hertz or so; that made me feel pretty comfortable about the accuracy of the counter.

Obviously, this is not a lab-standard frequency counter, but then you're not paying lab-standard prices, either. I've found that the accuracy and precision of the unit is sufficient for 99% of the applications around the shack—most of the time I just want to know whether a circuit is oscillating or not. I do suggest that you spend the extra few dollars for the 500-MHz prescaler, especially if you have VHF/UHF gear.

I encountered minor frustrations while building this kit, but none of the problems were insurmountable. The unit works great, and I think you'll not find a 500-MHz frequency counter at a better price.

For more information, please contact Dick Smith Electronics, PO Box 8021, Redwood City CA 94063; (800)-332-5373. ■

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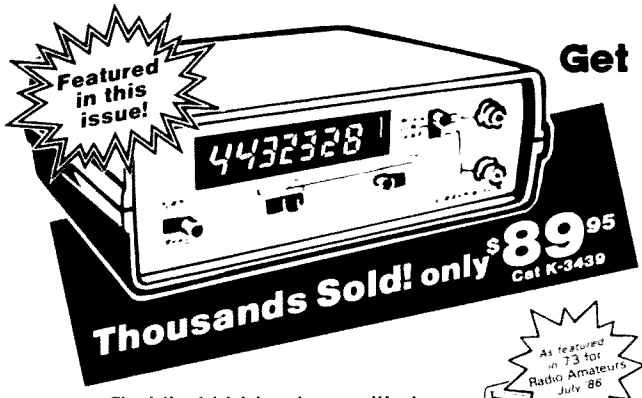
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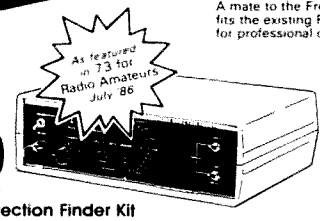
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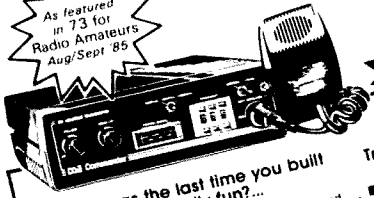
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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough, NH 03458-1194.

COAST GUARD FESTIVAL
JUL 30–AUG 3

The North Ottawa ARC will operate KA8USK aboard the U.S. Coast Guard Cutter *Macinaw* July 30–August 3 from 1700–0100 UTC as part of the Grand Haven Coast Guard Festival. Suggested frequencies: SSB—3.875, 7.265, 14.250; CW—7.050, 7.110, 14.050. For a commemorative certificate, send QSL and a 9 x 12 SASE to NOARC, Box 44, Ferrysburg MI 49404.

JACKSON HOLE WY
AUG 1–3

The ARRL Rocky Mountain Division Convention and the 54th annual Wyoming, Idaho, Montana, and Utah Hamfest will be held August 1–3 at the Virginian Motel. For special room rates, call the motel and mention "Hamfest." The A1 campground is next to the motel for first-come, first-served basis. For more information, contact George Siegel, 130 E. 17th Street, Idaho Falls ID 83401; (208)-523-7433.

OHIO STATE FAIR
AUG 1–17

The Columbus ARA will be operating special-event station W8TO on August 1–17 to promote the Ohio State Fair. Operation will be on 80 through 10 meters. Times and frequencies to be determined by persons manning the booth at the fair (11 a.m. to 9 p.m. EDT daily). A valid exchange includes name, QTH, and RST. For a commemorative certificate, send a log extract or QSL card and an SASE to W8TO, Attn: State Fair Event Coordinator, 280 East Broad Street, Columbus OH 43215.

PRO-FOOTBALL WEEKEND
AUG 2–3

The Canton ARC will operate special-event station W8AL to celebrate the Pro-Football Hall of Fame's Greatest Weekend on August 2–3, from 1700 to 2200 UTC each day. Operating frequencies will be: SSB—14.270 and 7.270; CW—14.060 and 7.060. For a special H.O.F. QSL card, send your card with an SASE to Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710.

AVIATION EXHIBITION
AUG 2–3

The Fox Cities ARC will operate station W9KKK August 2–3 from 1300–2200 UTC in conjunction with the 34th annual EAA International Fly-in Convention and Sports Aviation Exhibition in Oshkosh, Wisconsin. Suggested frequencies: 3.875, 7.250, 14.250. Send QSL and SASE to Dick Roll W9TA, 933 Melissa Street, Menasha WI 54952.

MT. DAVIS EXPEDITION
AUG 2–3

The Somerset County ARC will begin an expedition to Mt. Davis, the highest point in Pennsylvania, on August 2. Station AK3J will operate from 12 noon on August 2 to 12 noon on August 3 (EDT) in the lower 100 kHz of the General-class phone frequencies on 20, 40, and 80 meters; 10 and 15 meters depending on propagation; and 2m SSB. For an 8-1/2 x 11 certificate, send a QSL and large SASE to SCARC—Mt. Davis, RD#5, Box 223A, Somerset PA 15501.

VALPARAISO IN
AUG 3

The Porter County ARC will hold its hamfest on August 3, beginning at 8 a.m., at the 49'er Drive-In Theatre on State Road 49 in Valparaiso, Indiana. Admission is $3. Talk-in on 147.96/.36 and .52 simplex. For more information, write to PCARC, PO Box 1782, Valparaiso IN 46383.

ANGOLA IN
AUG 3

The Steuben County RA will present its 28th annual FM Picnic and Hamfest at Crooked Lake, Angola, Indiana, on August 3. Two miles north of Angola, I-69 to Crooked Lake Exit. Admission is $2.50. Inside tables for exhibitors and vendors available. Talk-in on 146.52 and 147.81/.21.

BERRYVILLE VA
AUG 3

The Shenandoah Valley ARC will sponsor its 36th annual Winchester Hamfest on August 3, from 7 a.m. to 3 p.m., at the Clarke County Ruritan Fairgrounds on Route 7, two miles west of Berryville, Virginia. Admission is $4, women and children under 12 are free. Tailgaters and limited tables $5. Talk-in on 146.22/.82 and 146.52 simplex. For further information, call Rob Kinsley NT4S at (703)-869-5113, or write SVARC at PO Box 139, Winchester VA 22601. Exams on August 2 at 9 a.m.—call Walt Quitter NC4B at (703)-869-5241, or send an SASE to 367 Buckingham Drive, Stephens City VA 22655.

WEST MIFFLIN PA
AUG 3

The South Hills Brass Pounders and Modulators ARC will hold its 49th annual hamfest on August 3 at the south campus of Allegheny Community College, located in West Mifflin, Pennsylvania, about seven miles south of Pittsburgh. Talk-In on 146.13/.73 and 146.52. For further information, contact Doug Wilson WA3ZNP, 185 Orchard Avenue, Emsworth PA 15202; (412)-761-1851.

49TH SOAP BOX DERBY
AUG 7–9

The Cuyahoga Falls ARC will operate special-event station W8VPV on August 7–8, from 6 p.m. to 11 p.m. EDT each day, and on August 9 from 9 a.m. to 3 p.m. EDT, at Derby Downs, Akron, Ohio, for the 49th running of the All American Soap Box Derby. Evening frequencies are 7.250 and 3.940. Daytime frequencies are 7.250 and 14.270. For a certificate, send a 9 x 12 SASE to W8VPV, PO Box 614, Cuyahoga Falls OH 44222, by September 15.

RIPLEY WV
AUG 9

The Jackson County ARC will sponsor its 9th annual hamfest on August 9 at the Jackson County Junior Fairgrounds, six miles west of Ripley, West Virginia. Admission is $3. Talk-in on .07/.67. For futher information, contact Les Shockey WB8SNO, RFD 2 Box 36, Sandyville WV 25275.

INDIANAPOLIS IN
AUG 9

The WA9SNT ARC will hold its annual swapfest on August 9, from 8 a.m. to 4 p.m., at ITT Technical Institute (across from the pyramids) in Indianapolis, Indiana. Flea-market setup begins at 6 a.m. Admission $2, students $1. Flea-market space $1. Talk-in on 146.94. For additional information, contact Dave Johnston K9HDQ, c/o ITT Technical Institute, 9511 Angola Court, Indianapolis IN 46268; (317)-875-8640.

JACKSONVILLE FL
AUG 9–10

Six major ARCs will sponsor the 13th annual Greater Jacksonville Hamfest and Northern Florida ARRL Section Convention, from 9 a.m. to 5 p.m. on August 9 and from 9 a.m. to 3 p.m. on August 10, at the Civic Auditorium on Water Street in downtown Jacksonville. Registration is $4, children under 16 free. Swap tables are $9 per day or $15 for the weekend. Exams at 1 p.m. on August 9—free for Novice, others $4. Talk-in on the W4IZ (.16/.76) repeater. For commerical booths and swap tables, send inquiries to Greater Jacksonville Hamfest, PO Box 10623, Jacksonville FL 32207; (904)-350-9193.

ESSEX JUNCTION VT
AUG 9–10

The Burlington ARC will celebrate its 50th Anniversary at the Burlington International Hamfest on August 9–10, all day both days, at the Champlain Valley Fairgrounds in Essex Junction, Vermont. Admission $4 U.S., $5 Canadian. Children under 12 free. Campers $5 U.S. per night. Talk-in on 146.34/.94. For more information, contact Barb Kimball N1DLE, 1 Sundown Drive, Williston VT 05495; (802)-878-5555.

MARION IN
AUG 10

The Grant County ARC will hold its 7th annual hamfest August 10 at the 4-H Fairgrounds in Marion, Indiana, beginning at 8 a.m. $2 donation in advance, $3 at the gate. $2 reservation for an 8-foot table. License exams will be given. For more information or tickets, send an SASE to Brooks

Clark WB9EAP, 2202 South Boots Street, Marion IN 46953.

ST. CLOUD MN
AUG 10

The St. Cloud ARC will hold a hamfest August 10 at Lake George in St. Cloud, Minnesota, near downtown, off MN 23 and U.S. 52. $3 ticket donation. Talk-in on .34/.94 primary, .615/.015 secondary. For more information, contact SCARC, Box 141, St. Cloud MN 56302.

WARRINGTON PA
AUG 10

The Mid-Atlantic ARC will hold its annual hamfest on August 10, 8 a.m. to 3 p.m., at the Bucks County Drive-In Theatre, Rte. 611, Warrington, Pennsylvania, five miles north of the Willow Grove Exit on the PA Turnpike. Tailgate setup begins at 7 a.m. Admission is $3 with $2 additional for each tailgate space. Tables not provided. Talk-in on WB3JOE/R (147.66/.06) or 146.52. For information, write MARC, PO Box 352, Villanova PA 19085, or call Bob Josuweit WA3PZO at (215)-449-9727.

GEORGETOWN KY
AUG 10

The Bluegrass ARS will hold the Central Kentucky ARRL Hamfest on August 10, from 8 a.m. to 4 p.m., at Scott County High School, Longlick Road and U.S. Rte. 25, Georgetown, Kentucky. Admission $4 in advance, $5 at the door. Outside flea-market space free. Technical forums, exams, and exhibits. Talk-in on .16/.76. For information or tickets, send an SASE to Scott Hackney KI4LE, 629 Craig Lane, Georgetown KY 40324.

LANCASTER OH
AUG 10

The Lancaster and Fairfield County ARC will hold its annual hamfest on August 10, from 8 a.m. to 4 p.m., at the Fairfield County Fairgrounds in Lancaster, Ohio. Admission $3 in advance or $4 at the door. Limited tables $4 in advance or $5 at the door. Table space $3 in advance or $4 at the door. Talk-in on 147.63/.03 or 146.52 simplex. For more information, write to Lancaster ARC, Box 3, Lancaster OH 43130.

WILLOW SPRINGS IL
AUG 10

The Hamfesters RC will hold its 52nd annual hamfest on August 10 at Santa Fe Park, 91st and Wolf Rd., Willow Springs, Illinois, to celebrate its 53rd year of service to ham radio in the Chicago area. Gates open at 6 a.m. $3 donation in advance, $4 at the gate, children under 15 free. $25 donation from exhibitors per 8-foot table in the pavilion. Talk-in on 146.52. For tickets, send an SASE and check to PO Box 42792, Chicago IL 60642. For general information, call (312)-598-4802.

LOUISVILLE OH
AUG 10

The Tusco W8ZX and Canton W8AL ARCs will present the 12th annual Hall of Fame Hamfest on August 10 at the Nimishillen Grange, 6461 Easton St., Louisville, Ohio. Registration is $2.50 advance, $3 at the gate. 30" by 96" tables available at $5 each (must reserve by August 1). Talk-in on 146.52/.52 and 147.72/.12. For more information or reservations, contact Bill MacNealy WD8LFM, RR#1 Box 442, Bolivar OH 44612; (216)-874-3483.

CAMP FORREST REUNION
AUG 15–16

The Middle Tennessee ARS will hold its first national reunion at Camp Forrest in Tullahoma, Tennessee, to commemorate the camp's use as a training center and POW camp during WWII. The club will operate station W4UOT from 6 p.m. to 10 p.m. (CDT) August 15 and from 1 p.m. to 10 p.m. (CDT) August 16. Frequencies: SSB—3.860, 7.235, and 14.240; CW—3.737 and 7.137. For more information or a commemorative certificate, send an SASE and QSL to George Stone WD4CYV, 712 First Ave., Tullahoma TN 37388; (615)-455-5993.

BREWSTER NY
AUG 16

The Putnam Emergency Amateur Repeater League is having its Electronics Extravaganza on August 16 at the J. F. Kennedy Elementary School in Brewster, New York, from 9 a.m. to 4 p.m. Admission is $3, children under 12 free with adult. Indoor tables $10 (with one admission), tailgating $5. FCC exams. Talk-in on 144.535/145.135. For information, contact R. Dillon N2EFA, RFD#7, Noel Court, Brewster NY 10509.

RHINELANDER WI
AUG 16

The Northwood ARC will hold a swapfest on August 16, at South Park School, 511 South Pelham St., Rhinelander, Wisconsin, from 9 a.m. to 3 p.m. Setup begins at 8 a.m. Admission is $1. Talk-in on 146.34/.94. Exams given for Tech and above, $4. For more information, contact Leonard Bauman K9RMN, 1312 Dorothy St., Rhinelander WI 54501; (715)-369-3296.

ROCHESTER IBM 30TH
AUG 16

The IBM RC will operate special-event station WD0GNK on August 16 from 1400–2100 UTC to celebrate the 30th anniversary of the IBM Corporation in Rochester, Minnesota. Frequencies: phone—14.240, 7.280; CW—7.140; and 146.22/.82. For a certificate, send a QSL and SASE to WD0GNK—IBM RC, IBM Corp., Department 868, Highway 52 North, Rochester MN 55901.

GREEN BAY WI
AUG 16

The Green Bay Mike & Key Club will hold its summer swapfest on August 16 at a new location: Community Service Center, 1673 Dousman St., Green Bay, Wisconsin (take the Dousman/Shawano Ave. Exit off Highway 41). Doors open at 7 a.m. Free admission. 8-foot tables $5; four-table limit (by reservation only; send SASE with name, call, address, and check payable to Green Bay Mike & Key Club, c/o Cathy Strommen KD9WO, 1500 Main St., Green Bay WI 54302). Exams given (register with Larry KD9IA, 1005 S. East St., Apt. 111, Appleton WI 54915). Talk-in on 147.72/.12 and 147.96/.36.

RAILROAD DAYS
AUG 16–17

Great Plains ARC station KC0CP will operate from Oelwein, Iowa, in conjunction with Railroad Days. Frequencies will be 14.235, 7.235, and 3.970, ±10 kHz. For a certificate, send QSL and SASE to KC0CP, Box 203, Oelwein IA 50662.

HUNTSVILLE AL
AUG 16–17

The Huntsville, Alabama, RC will hold Alabama's largest hamfest on August 16–17, at the Von Braun Civic Center, beginning at 9 a.m. each day. Admission is free, flea-market tables $8. Talk-in on 146.34/.94. Exams Saturday at 9 a.m. at the Huntsville High School. For further information, call Frank Brown at (205)-852-6324 (motels), Alen Forney at (205)-837-5936 (dealers), or Dave or Gwenn Givens at (205)-883-2760 (flea market).

TACOMA WA
AUG 16–17

The Radio Club of Tacoma (W7DK) will celebrate its 70th anniversary at the 18th annual Tacoma Hamfair, August 16–17 at the Pacific Lutheran University in Tacoma, Washington. Registration $5, banquet $10, dormitory rooms $14 (single) or $20 (double), reserved parking $2. Exams given. Talk-in on 147.28. Register with Grace Teitzel AD7S, PO Box 45079, Tacoma WA 98445, or call Eva Anderson WB7QNS at (206)-564-8347.

SAN ANGELO TX
AUG 16–17

The San Angelo ARC will celebrate the Texas Sesquicentennial at the CENTEX Hamfest '86, August 16–17, at the San Angelo Convention Center. Preregistration is $5, $7 at the door. Exams given. Talk-in on 3.922, 7.213, .52, and .34/.94. The club will also operate special-event station W5QX. Commemorative QSL cards are available. For more information, write to SAARC, Box 3751, San Angelo TX 76902.

GEORGETOWN DE
AUG 17

The Sussex ARA will sponsor the Delmarva Hamfest on August 17 at Del. Tech. Community College, from 8 a.m. to 4 p.m. The college is located west of Georgetown on Delaware 18, a quarter mile from the U.S. 113 intersection. Advance registration is $2.50, $3 at the gate. Inside tables are $3, tailgating $2. Exams given. Talk-in on 147.075 and 146.52. For information and advanced ticket registration, write Delmarva Hamfest, Rte. 2, Box 244G, Georgetown DE 19947.

ARGOS IN
AUG 23

The Marshall County ARC will hold its hamfest on Saturday, August 23, at the Marshall County 4-H Fairgrounds on State Rte. 10 between U.S. Bypass 31 and Business 31, from 8 a.m. to 2 p.m. Advance tickets $2, $3 at the door. Indoor and outdoor areas; numerous electrical outlets; 8-foot tables $5. For further information, write the Marshall County ARC, PO Box 151, Plymouth IN 46563, or call Bob Nellans KB9DE at (219)-892-5224.

OAKLAND NJ
AUG 23

The Ramapo Mountain ARC

(WA2SNA) will present its 10th annual flea market on August 23 at the Oakland American Legion Hall, 65 Oak Street, Oakland, New Jersey, 20 miles from the GW Bridge. Admission $1, non-ham family members free. Indoor tables $6.50, tailgating $3. Talk-in on 147.49/146.49 repeater and 146.52 simplex. For info and advance space reservation, send an SASE to Frank Lee KA2ALS, 989 Crystal Lake Terr., Franklin Lakes NJ 07417; (201)-337-2290, or Tom Risseeuw N2AAZ, 63 Page Drive, Oakland NJ 07436; (201)-337-8389 (after 6 p.m.).

ITHACA NY
AUG 23

The Tompkins County ARC will sponsor its annual Finger Lakes Hamfest August 23 from 8 a.m. to 4 p.m. at the Trumansburg Fairgrounds, 12 miles northwest of Ithaca, New York, on Rte. 96. $3 admission and $1 for flea-market space. Reserved indoor tables $5 each. Children under 14 free. Talk-in on .37/.97 or .52. For information, contact David G. Flinn W2CFP, 866 Ridge Rd., Lansing NY 14882; (607)-533-4297.

DAYTON OH
AUG 23–24

The Dayton Microcomputer Association will hold Computerfest '86 on August 23–24 from 10 a.m. to 6 p.m. at Dayton's Hara Arena, located off I-75 at the Needmore Exit (#58). Admission is $2, children under 12 free. Flea-market spaces $10 before July 1, $15 afterwards. For more information or to reserve space, call Mark Hanslip at (513)-268-7225, or write to Computerfest '86, 143 Schloss Lane, Dayton OH 45418-2931.

VIRGINIA BEACH VA
AUG 23–24

The 1986 ARRL Roanoke Division Convention and 11th annual Hamfest and Computer Fair will be held August 23 and 24 from 9 a.m. to 5 p.m. at the Virginia Beach Pavilion. Admission is $5 in advance, $6 at the door. Flea-market tables $5 per day, electricity $10 extra for both days. Pre-registered exams given Sunday at 9 a.m. For information and tickets, contact Manny Steiner K4DOR, 3512 Olympia Lane, Virginia Beach VA 23452; (804)-340-6105.

ST. CHARLES MO
AUG 24

The St. Charles ARC will sponsor HAMFEST86 on August 24 at Blanchette Park (new site) in St. Charles, Missouri, from 7 a.m. to 2:30 p.m. Free admission. $2 donation for tailgate flea market. Forums and FCC exams at 10 a.m. Talk-in on 146.07/.67 repeater, 146.52 simplex. For more information, contact Eric Koch NF0Q, 2805 Westminister, St. Charles MO 63301; (314)-946-0948.

SAGINAW MI
AUG 24

The Five County Swap-N-Shop committee of Michigan will sponsor its 10th annual Swap-N-Shop August 24 at the Saginaw Civic Center, beginning at 8 a.m. Advance tickets $2, $3 at the door. $7.50 for an 8-foot table, $3 per car for a covered "trunk sales" area. Talk-in on 147.84/.24 and 146.52. For more information, call Don at (517)-893-3475. For advance tickets and table reservations, send check to Five County Swap-N-Shop, PO Box 1783, Saginaw MI 48605-1783.

MARYSVILLE OH
AUG 24

The Union County ARC will present the 10th annual Marysville Hamfest and Auction on August 24 at the Fairground in Marysville, Ohio (near Columbus). Gates will open at 6 p.m. on Saturday for free overnight camping. Advance tickets are $3, $4 at the gate, children are free. $1 per 10-foot flea-market space, electric power is $2 extra. No tables available. Talk-in on 146.52 or 147.99/.39. For further information, contact Gene Kirby W8BJN, 13613 U.S. 36, Marysville OH 43040; (513)-644-0468. Include an SASE.

BLUEFIELD WV
AUG 24

The East River ARC will sponsor the Bluefield Hamfest on August 24 from 9 a.m. to 3 p.m. at the Brushfork Armory, one mile north of Bluefield, West Virginia, on U.S. 52. Admission is $4, children under 12 free. Walk-in exams at 9 a.m. Talk-in on 144.89/145.49 and 146.52. For more information, write to Jim Perdue KC8NG, Rte. 5, Box 457, Bluefield WV 24701.

CAMP HILL PA
AUG 24

The Central Pennsylvania Repeater Association will hold its annual Electronic Exhibit/Ham/Computerfest on August 24 at the Penn Harris Inn and Convention Center, Routes 11 and 15, Camp Hill, Pennsylvania. Gates open at 8 a.m. $4 admission, XYLs and children under 12 free. Exams begin at 9 a.m. Talk-in on 145.47 (WA3KXG) and 146.52. For hotel reservations, call Penn Harris Inn & Convention Center at (717)-763-7117; mention CPRA for reduced rates. For more information or reservations, contact Paul McDonnell N3BKI, 1207 Apple Drive, Mechanicsburg PA 17055; (717)-697-1880 (12 noon to 8 p.m.).

MULLICA HILL NJ
AUG 24

The Gloucester County ARC will celebrate its 27th year at its 8th annual hamfest on August 24 from 8 a.m. (7 a.m. setup) to 4 p.m. at the Gloucester County 4-H Fairgrounds, Rte. 77, Mullica Hill, New Jersey. Tickets are $3.50 in advance, $4 at the gate. Sellers additional $4 per space or $4.50 with ac power. Indoor tailgating. Exams at 9:30 and 1:30 at Stephen's Hall. Talk-in on 147.78/.18 and 146.52. For information and advance tickets, write to GCARC, PO Box 370, Pitman NJ 08071, or call John K2FJ at (609)-589-2318, Milt K3WIL at (609)-845-7000 (daytime), or Ginny Martin N2FJM at (609)-694-4442 (evenings).

LABOR DAY TRAVEL
AUG 30–SEP 1

The Tri-City ARC will operate special-event station KA1BB from the Waterford, Connecticut, I-95 weigh station to promote safe Labor Day holiday auto travel. This event is in conjunction with the fourth annual Stay-Awake Coffee Stop offered by BSA Troop 24 of Niantic CT. Mobile operators are especially encouraged to call. Operation will be from 1700 UTC August 30 through 2300 UTC September 1 on 14.295, 7.245, and 3.395 (phone) and on 7.130 (CW). Talk-in to coffee shop on FM 146.52 direct and CB channel 19. QSL via Tri-City ARC, PO Box 686, Groton CT 06340. For information, please contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325 (work).

OK CORRAL
AUG 30–SEP 1

The Old Pueblo RC will operate its 5th annual special-event station W7GV from 1300 UTC August 30 to 2200 UTC September 1, from the famous OK Corral at Tombstone, Arizona, site of the famous shoot-out between the Earps and Clantons in 1881, in celebratrion of the Rendezvous of the Gunfighters. Frequencies: SSB—21.380, 14.280, 7.280, and 3.980; CW—14.060, 7.130, and 3.730. Send a QSL with an 8-1/2 x 11 envelope and 40 cents postage to W7GV, PO Box 42601, Tucson AZ 85733.

LEBANON TN
AUG 31

The Short Mountain Repeater Club will sponsor the Lebanon Hamfest on August 31 at the Cedars of Lebanon State Park, U.S. Highway 231, Lebanon, Tennessee. Bring your own tables. Talk-in on 146.31/146.91. For further information, contact Mary Alice Fanning KA4GSB, 4936 Danby Drive, Nashville TN 37211.

LANCASTER PA
AUG 31

The Red Rose Repeater Association will hold a computerfest on August 31 from 9 a.m. to 3 p.m. at the Guernsey Sales Pavilion, four miles east of Lancaster on Rte. 30 at Rte. 896. $3 donation, children under 14 free when accompanied by an adult. Talk-in on 147.015. For information, send a SASE to Computerfest Committee, PO Box 5029, Lancaster PA 17601.

SCHAUMBURG SEPTEMBERFEST
AUG 31

The Schaumburg ARC will operate club station WB9TXO on August 31 from 1600–2100 UTC from the grounds of the Schaumburg Septemberfest. Suggested frequencies are 7.286, 14.286, and 21.386. For a certificate, send a QSL to SARC, PO Box 94251, Schaumburg IL 60194.

BLOOMINGTON IN
AUG 31

The 9th annual Bloomington Hamfest will be held on August 31 from 8 a.m. to 2 p.m. at the 147.78/.18 repeater site at 2335 Vernal Pike off the SR 37 bypass. Admission $2. No tables available. Exams given. For further information, contact Bob Myers K9KTH, 306 S. Fairview Street, Bloomington IN 47041; (812)-332-1105. Include an SASE.

NORWALK CT
SEP 7

The Fairfield, Norwalk, Stamford, and West Haven ARAs will sponsor the Fairfield County Hamfest on September 7 from 9 a.m. to 5 p.m. at the Norwalk National Guard Armory, off Exit 38 Merritt Parkway. Admission is $3, tailgating $5, tables $10, power free. Talk-in on 147.39/.99 and 146.52. To register, write to PO Box 326, West Haven CT 06516.

73 INTERNATIONAL



AUSTRALIA

Jim Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

VK7 QSL BUREAU

From Chas Harrisson VK7CH comes an interesting report on the last three years of the VK7 QSL Bureau.

A point of interest is that there appears to be a 3,000-card shortfall each year between cards coming in and cards going out. A second point that affects all amateurs waiting for their VK7 cards, whether it be for their "Tassie Devil" award or just a confirmation, is the time delay the bureau has waiting for packets of cards from overseas bureaux. QSL cards for the last three years are shown in Table 1. The peak year was 1980, with a total of 49,062 cards.

In and out cards are inflated this year by 7–8,000 by cards received from overseas bureaux for VK75A, the special anniversary call, and these had to be sent on to VK3.

A noticeable number of overseas bureaux now send cards at longer intervals. Only two lots have been received during the year from both the U.S.A. and U.S.S.R.

MACQUARIE ISLAND

In another snippet from VK7 comes the news that Sjored VK7ZSJ, or "Sojo" as he is called by his friends, left Hobart in early March for Macquarie Island, where he will stay for the winter and will operate as VK0SJ for at least the next nine months. He will take his HF gear, with the TONO for RTTY and 2m gear for the robot satellites.

A keen group of VK3ers have pooled in and given Sojo, on loan for the year, a callsign keyer for the 2m and 6m beacon, a 6m transceiver, a 6m and 2m linear, 6m and 2m yagis, and power supplies. So, says Sojo, "Keep an ear out" on the 6m and 2m bands for the beacon. The exact frequencies will be announced when the equipment is installed and minimum interference with scientific equipment is determined.

If you are interested, keep an ear out on his regular HF skeds with VK7VK, VK7HK, or VK7RM around 0900 UTC on 14.120 MHz, also on Mondays and Fridays at 0930 UTC on 7.085 MHz. QSL is via VK7RM; no CW as Sojo has a limited call in VK.

Why no CW, you might ask? Australian amateurs have been granted a concession by our DOC. Those holding a lower class license than the full call (e.g., Novice, Limited, or a combination of both) are granted full call license privileges while operating from remote areas such as Antarctica, Willis Island, Heard Island, etc., for the duration of their stay in these places. Their license automatically reverts back to their original class when they leave. As Sjored is very, very competent technically, all the limited license means is that he has never either sat for or passed the CW examination to upgrade to full call privileges within Australia.

PREDECESSORS PRAISED

At the WIA's 75th Anniversary Dinner, Mr. R.E. Butler, Secretary General of the ITU, in front of an assemblage that included our Governor, plus other distinguished people, gave praise to our sometimes forgotten experimenters of the past. He stated that he was "deeply honored [to speak before] the oldest institute of its kind in the world."

Mr. Butler noted that amateur radio was the only hobby provided for by the International Telecommunications Convention, which defined it as an activity carried on by duly authorized persons interested in radio technique "solely with a personal aim, and without pecuniary interest." This provided a precedent for the 1971 naming of the Amateur Satellite Service at the World Administrative Radio Conference for Space Telecommunications.

The Secretary General said that the worldwide recognition emerged over decades from the solid and reliable characters of renowned radio enthusiasts in Australia and elsewhere. Even before the WIA, came "the example and brilliance of Sir Charles Todd and his team for . . . the overland telegraph," he noted, adding mention of the first public demonstration of wireless telegraphy by Professor William Bragg in 1897, at the University of Adelaide.

Lauding the regularly received help over the years from the "Post Office," Mr. Butler then recalled the names and exploits of Jenvey, Bartholomew, Maclurcan, Read, Coxon, Davis, Traeger, Reverend Flynn, and Sidney Witt. He spoke of "Fisk and Hooke, and a legion of talented engineers" without whom there never could have developed The Flying Doctor Service, School of the Air, civil aviation, or The Public Telegraph Service, not to mention the many outback centers' services.

Remarking that radio amateurs were involved in exploring space long before its material use, he concluded, "Allow me to salute the predecessors who set the promotion of the radio techniques in action and I wish the institute long service and prosperity."

	1985	1984	1983
Cards received	10,455	11,015	16,300
Cards sent	7,096	7,672	11,696
Total	17,551	18,687	27,996

Table 1. QSL cards.



AUSTRIA

Osterreichischer
Versuchssenderverband
Theresiengasse 11
A-1180 Vienna
Austria

The O.V.S.V. (an IARU member) announces its Austrian prefix contest (AOEC 160m), which will take place the third weekend in every November, 1800 UTC Saturday to 0700 UTC Sunday, on 1810–1950 kHz. (Participants must be careful to observe their national regulations for 160m!)

CW only, licensed radio amateurs worldwide (in Austria, OVSV-members only) and SWLs are eligible. Contest call: CQ TEST/CQ OE; exchange: RST and serial number starting with 001; Austrian stations give RST and a three-digit number for the individual ADL (Austrian District Locator).

Count one point for each contest QSO, with multipliers: each worked Austrian call area 2, and 1 multiplier count for each ADL and for each prefix worked. The total score is the sum of all QSO points times the sum of all multiplier points. Log format for reporting should be A4 size, written on one side only. The AOEC standard log and summary sheet is preferred and may be requested (forms 017 and 018). Write to OVSV-AOEC160m at the above address.

Please send entries to OVSV-AOEC160m also, postmarked no later than December 31 of the contest year, accompanying the summary sheet(s) with the statement: "I declare that this station was operated strictly in accordance with the rules of the contest as well as within the national radio regulations."

Unmarked duplicate logsheets will not count and will result in a 5-point reduction in score. Certificates will be awarded to the 10 leading entries from each continent; results will be reported to IARU Region 1 and each society from which came entries.



FRANCE

Claude Guee FD1DGY
11 Rue Emile Labiche
28100 Dreux
France

After a long silence due to a car crash and some other QRM, here is some news from France, for a *73* Magazine that is more and more interesting! Bravo!

NEW CALLS

You can hear calls like FB1XYZ between 7.020–7.040, 14.050–14.100, 21.050–21.150, and 28.000–28.100. These are QRP stations—20 Watts—and new beginners. Without code tests, these beginners should be FA1XYZ, with only some channels on the

2-meter band and without repeater access.

Test exams are now carried out on the "Minitel" system, in different centers. (This is the French directory computer system issued from the PTT, allowing for a lot of services including this opportunity for direct examinations.) According to the authorities, only 30% of the candidates are failing, and these mainly because of lack of knowledge of the rules and regulations. Generally speaking, the candidates prefer this system; results show that a radio-club training is very helpful for the successes.

Another use of Minitel: Owners of terminals can receive directly from CNET propagation conditions, which are updated every day.

RECIPROCAL AGREEMENTS

There now are reciprocal operating agreements between Luxembourg, Monaco, West Germany, and France: licenses now are permanent. Maybe this is a first step toward a full European license. Others should apply to: DTRE CGRP, Service Amateur, BP 75, 94002 Creteil Cedex, France. Your call in France will be, for example, F/W, for at least three months (and for a year, eventually). The former F0 calls do not exist anymore. Countries now having reciprocal agreements with France are Australia, Austria, Belgium, Brazil, Canada, Denmark, Greece, Israel, Italy, Ivory Coast, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, the U.S.A., and Yugoslavia. Under negotiation are agreements with Argentina, Monaco, Ireland, Oman, and Japan.

MISCELLANY

The **QSL Bureau** via Reseau des Emetteurs Francais (REF) address now is BP 273, 81209 Mazamet, France. While HQ is still in Paris, some activities are being decentralized to save money.

SWLs have received an official call after waiting for years. Now they can send nice QSL cards, like F11XYZ. Other modifications include FF for club stations—for example, F6KXY becomes FF6KXY; Corsica is IK instead of FC; Antarctica and Australs Islands are FT instead of FB.

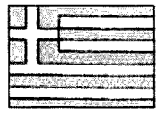
Law Story: Very bad news—now it is not allowed to install any aerial of a size bigger than 4 meters (13 feet) without authorization, for reception or emission. No minibeam but now microbeam!

Arsene: The French amateur satellite is alive and the launch should be scheduled by the end of the year. Two modes will be available: B and F.

F0OX (Clipperton Harbor) will become a permanent base. Two months ago the French government announced a project of a harbor for fishing boats on this famous atoll. This would mean the end of one of the most attractive DX contacts . . . but wait and see. . . .

TP21. Conseil de l'Europe, Strasbourg, France: This new call is not yet on the air. Delayed due to an unexpected amount of formalities. (CDXC information.)

Best 73 from France.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

In my previous column, I analysed the hardware of our newest repeater (R0) and I will continue here to describe its software part, too. Speaking about the software, somebody might wonder why it was necessary. The answer is because the repeater is far away from Athens on a mountaintop, some 1,600 meters above sea level, and besides that, it is very difficult to go during winter time because of the snow, even for the two local hams in Kalamata, a nearby city.

Let's see now what the logic does. At first it checks every two hours the capacity of the batteries, and if the batteries have more than 60 Ah then the R0 is on high power, but if capacity is between 30–60 then R0 switches to low power, and if capacity is lower than 30 Ah then it goes to self-protecting mode during which it sends only its ID if triggered and the telemetry every two hours.

There is no restriction of repeater operating time during summertime, but during winter it depends on many factors. If the photovoltaic panels cannot supply charging current at all, then R0 can operate on high power for three days if operated 4–5 hours daily; after three days, Its logic will switch it to low power and can again be operative for six more days (4–5 hours daily).

If still no current is coming from the panels, it goes to self-protection mode and only sends the telemetry in high power for 25 more days. If things still look gloomy, it then goes to sleep. Every time the repeater sends information about its state during the telemetry, if it is on low power it sends SV3A Low Power. If it is not working because of the batteries, it sends SV3A Idle Mode. And finally, when closed, it sends SV3A Closed.

The whole system can be telecommanded and some corrections can even be made from distance. There is also a station devoted to record every telemetry transmission from it. At the end of the day, all information is entered in a computer and further analysis is made. Useful conclusions can then be extracted in order to help more of these self-contained units to be installed all over Greece.

Additionally, when R0 sends 00 during the hot summer days, that means that the temperature sensor is giving overflow and temperature is over 40 C. If it gives M5 or M10, that means that temperature is below zero—minus 5 or 10.

Finally, the repeater sends its ID after the end of someone's transmission, and, if more than 3-1/2 minutes after the last one was sent, timeout is set on 95 seconds.

Now, eight months after the repeater's installation, everything goes perfectly OK. We had no problems during winter time, and it looks as if our new friend is very promising as the first member of a new generation of repeaters in our country. We hope to have some more repeaters like this installed here in Greece before long, but don't worry: You'll be the first to know, here in *73* Magazine!



INDONESIA

Erlangga Suryadarma
YB0BZZ/V85BZ
ORARI National QSL Bureau
PO Box 96
Jakarta 10002
Indonesia

(73 International welcomes Indonesia, and its representative, YB0BZZ, QSL Manager and IARU Region III Liaison Officer, who has provided most of the following information. Much of this came from a paper he and Ben S. Samsu YB0EBS prepared for last November's IARU Region III meeting in New Zealand.)

Unlike many neighboring countries, Indonesia has not abolished or curbed all ham activity. All Indonesian hams must by law be members of ORARI (Organisasi Amatir Radio Indonesia), and there are no provisions for guest operators at present.

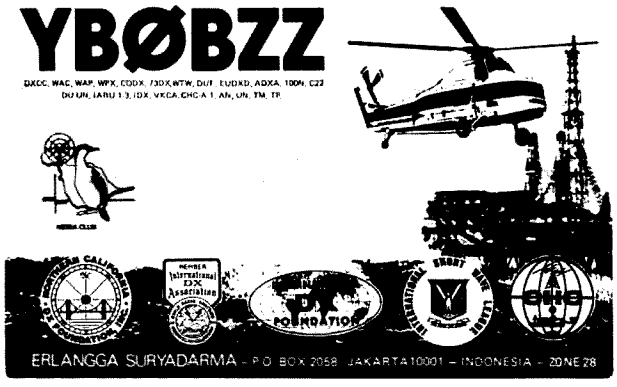
The Amateur Radio Service began here in the 30s when the country was the Netherlands East Indies. Two pioneers worthy of mention were Rubin Kain YB1KW (licensed in 1932) and B. Zulkarnaen YB0AU (licensed in 1933), silent keys as of 1981 and 1984, respectively.

All amateur radio activity was suspended by the Japanese occupation authorities at the beginning of World War II, but a number of stations went underground fighting for Indonesian independence. When independence was proclaimed in 1945, the declaration was transmitted throughout Indonesia and the world using a "simple homemade revolutionary radio" constructed by Gunwan YB0BD; the rig now occupies a place of honor in Indonesian independence history and is on exhibit in the Indonesia National Museum.

During the next four years (ending December 27, 1949 with the Dutch ceding sovereignty), a young amateur by the name of Syarifuddin built home-brew transceivers, which were used to maintain communications between the Indonesian islands—particularly between Java and Sumatra. He now is a high-ranking professional in the Directorate General of Post and Telecommunications and a supervisor for ORARI.

Internal security problems led to the suspension of any nongovernmental radio services activity from 1950 to 1967. In 1967, the Amateur Radio Service was re-established. At present, amateurs are subdivided into three classes of skill and proficiency, with only the top class being permitted to contact foreign amateur stations. All belong to the "Lokal" (district) level of ORARI, which is part of the "Daerah" (provincial) level of ORARI.

Foreign citizen radio amateurs, upon issuance of a temporary residence permit, are permitted to apply for amateur operating privileges on a reciprocal basis. This is



possible now for nationals of the U.S.A., the United Kingdom, Canada, Australia, the Federal Republic of Germany, the Netherlands, Sweden, Belgium, France, Argentina, and Finland.

Growth of activity was slow between 1967 and 1980 (from about 200 hams to about 5,000), but with some new simplified regulations and new availability of ready-for-use (factory-built) rigs, there was a big rush for amateur tickets. It seems likely that 40,000 will prove to be an accurate figure for earty 1986 despite an alarmingly high dropout rate among the Novices (80% of the total membership of ORARI), about half of whom do not renew their licenses. Burdensome procedures involved in renewing may have a lot to do with this.

ORARI is currently involved in hard work to achieve better structure and organization, simpler regulations, and more professional operation in all ham matters. International *Callbook* material is badly out of date, "and it is suggested that all correspondence and QSLs be handled through the ORARI National QSL Bureau" (address above).

RADIO SOCIETY BEHIND A BAMBOO CURTAIN

The existing general rules for amateurs issued by the Directorate General of Post and Telecommunications were derived from outdated 1968 material—a time when sophisticated UHF/VHF/RTTY/SSTV/AMSAT, etc. were unknown in Indonesia. However, within the last three years, a "gap" has occurred between the rules and common "incorrect practices" of so-called "radio operators."

ORARI has constantly submitted concepts and ideas to improve the existing rules, but the government has to concentrate efforts on the development of a national communications system, so that little attention has been paid to ORARI beyond the regular State Examination to accommodate the enthusiasts. ORARI still hopes, however, that more comprehensive regulations will be available before the end of the year.

While ORARI has 40,000 registered members, only a mere 5% are DXers. The majority squeezed themselves into the crowded VHF/UHF band. This creates the impression of "a radio society behind a bamboo curtain" to the amateurs of the outside world, due to the scarcity of the international contacts established.

A lack of training on DX matters among senior amateurs, some shy and uncertain of their English, did not set an example for younger amateurs to follow. Between 1967 and 1982 the radio society had only seven DXCC holders! With the establishment of training programs in the past two years, 15 DXCC awards have been made, including one 5BDXCC, for a total now of 23.

Continued next month.



THAILAND

Tony Waltham HS1AMH
c/o Bangkok World Newspaper
Soi Saladaeng
Bangkok 10500
Thailand

Amateur radio in Thailand is about to be legalized. Indeed, by the time that you read this it will most likely be a fact, for the final draft of the legislation—the provisions for administration, the separate license classes and required qualifications—has been prepared by the Thai Post and Telegraph Department.

It is not that amateur radio was ever illegal, and no, don't disallow any HS contacts you may have had. It is simply that up until now our hobby has been officially sanctioned only for special events, such as contests. Prior to that, members of the Radio Amateur Society of Thailand operated according to an understanding with the authorities.

Late last year the National Security Council approved amateur radio as being an activity not detrimental to society (or security), thanks to a petition led by the Post and Telegraph Department.

Senior members of the Radio Amateur Society of Thailand have also played an active behind-the-scenes role in getting the activity recognized and legitimized.

In a series of meetings following the NSC's approval of amateur radio in principle, RAST members and senior PTT officials worked out a draft for the regulations and administration of the hobby. At the time of writing, the following salient points regarding amateur radio have emerged:

- The minimum age for applicants for a license will be 15 years of age, and they should be Thai nationals.
- Qualified foreign residents will be able to apply to operate under reciprocal operating privileges to be set up with corresponding administrations abroad.
- A National Security Council or Police clearance would be required before an amateur radio license will be issued, while membership of the Radio Amateur Society of Thailand will also be a requirement as the society will play a major role in controlling the activity, especially on HF.
- Three license classes are envisaged: a Novice class offering VHF only, with the full two-meter spectrum available; a secondary HF class with a Morse code requirement; and a first-class license with Morse code capability both in the Thai language and in English being required.
- Those applying for an amateur radio license will need to be seconded or endorsed as a person of good standing by a member of the radio club.
- A basic knowledge of English will be required for an HF class license. This is to enable Thais to be able to conduct a basic QSO with radio amateurs abroad.

These are just some of the points in the draft for the administration of amateur radio in Thailand which have taken both international and national considerations into account.

RAST also has filed an application with the PTT to operate a club station for demonstration and training purposes after the regular monthly club meetings at the Singha Bier Haus (conducted from 11 a.m. on the first Sunday of each month). Initially, club stations are envisaged by the authorities, with the first two being at the Asian Institute of Technology and at the Science Museum in downtown Bangkok.

It is hoped that operations from private homes will be permitted later, but progress will be on a step-by-step basis; to have a fully legislated amateur radio service in Thailand is an achievement in itself—one for which RAST has been actively campaigning for 22 years.

For most DXers, the best chance to contact Thailand will be during one of the major international contests which the club's members operate with the call-sign HSØA. Typically, we make between 3,000 and 4,000 QSOs in a 48-hour period, and often stateside stations give us reports of 5 and 9 plus 20, "and I'm surprised no one else is calling you."

It seems that all too often U.S. and even European stations swing their beams away from Asia while the band is still open—and miss a chance if they need Thailand or Zone 26.

For everyone's diary, Table 2 shows the major international contests which we intend to participate in over the coming year.■

Date	Contest	Mode
Jun 21/22	All Asia	Phone
Jul 12/13	IARU	Phone/CW (begins 7 p.m. July 12 for 24 hours)
Jul 19/20	SEANET	CW
Aug 16/17	SEANET	Phone
Aug 23/24	All Asia	CW
Oct 25/26	CQWW	Phone
Nov 22/23	CQWW	CW

Table 2. Major international contests Thailand will participate in.

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80

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NEVER SAY DIE

from page 12

tures of the exhibits for use in your next year's brochure?

Remember to send a letter to the exhibitors after the show, getting their input—and possibly some good quotes for your next year's sales pitch. You'll also get some ideas on ways to improve.

The local hams already know about your local attractions, so you don't have to lay that on 'em, but those from further out may know less about it than you think. You might get them to come in Thursday night and spend Friday with their families having family fun—with perhaps a three-hour Friday evening hamfest opener for the commercial exhibits—say 4–7 p.m. This could be the same time the flea marketers come in and set up their tables. The industry meeting could then begin at 7, complete with some snacks.

It's often difficult to get your local hams to come. I frequently hear any number on the local repeaters who aren't bothering. You need to come up with a spiff to get these dead heads off their duffs. Prizes will usually do it. Not so much big ones as a lot of smaller ones and a big to-do about how many prizes there are.

You might think in terms of arranging meetings of special interest groups—and I mean beyond a talk on the program. Do you have a time and place for the 10/10 fanatics to meet? The 12/12ers? The SWOTs? SSTVers? RTTYers? Packet radio? Certificate hunters? DXers? 160m? UHFers? Microwavers? 6m? County hunters? OSCAR users? Repeater owners? Repeater coordinators? Weather satelliters? YLRL? Traffic handlers? Emergency net groups? Give each group a time and place to meet and you'll pull 'em out of the woodwork.

How about having some stickers for each of these fanatic groups available when the hams sign in so they'll be able to spot their fellow fanatics? If you're keeping a data base of the hams who register you can also key in their interest and make it easier to get them back next year with special programs of particular interest to them. Today's computers make this simple.

Now, I mentioned the critical importance of ham dealers. Hams may enjoy getting on the air, but most of all they enjoy buying something new. With enough dealers, your attendees will have a wide variety of ham gear available and at reasonable prices. I suggest, in addition to the usual brochures and mailings, that you call ham dealers and tell them what a bunch of buying fanatics you have ready to unleash on their piles of rapidly aging ham gear inventory. Here's the place to bring the stuff that has been gathering dust—mark it down and turn it into money.

It won't hurt if you can round up a few club members to help dealers move their stuff in (and out, later). Can you provide a club member to relieve smaller exhibitors at their booth so they can get around and see the hamfest for an hour?

To find out how good your speakers are, make up some forms to report on which forums were attended and how interesting they were. This will give you a good idea of how many attended each forum and whether you need to look for someone more interesting next year. You can make sure these reports are handed in at the end of the hamfest by having a special post hamfest drawing.

Well, there are some ideas... let's see what you can do with 1987!

Hmmm, you say you want me to come and give a talk? Sorry, I'm pretty well booked up for 1987. Of course, if you have the budget, I might be able to make an exception. In general I'll be planning to see you at Miami, Orlando, Dayton, Dallas, or Atlanta. Don't let me down. Remember, amateur radio and *73* are at the very best nonprofit ventures for me, so my priorities tend to lean toward digital audio, 8mm video, publishing, and computer shows.■

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QSL CARDS: 100 for $6.25 and 500 for $20 postpaid—SASE for a sample: Ken Hand WB2EUF, PO Box 708, East Hampton NY 11937. BNB388

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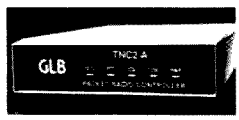
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PROPAGATION

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

Notes: Solar activity low. Geomagnetic field unsettled to active during days designated as 'F' or 'P'. Propagation conditions on HF bands typical for midsummer. Static on 160/80/40/20 on many days. 20 open until long after dark. 15 openings—short skip. 10 open occasionally—mostly sporadic-E. VHFers look for meteor/tropo propagation.

G=Good, F=Fair, P=Poor

AUGUST

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P–F	2 F
3 F–P	4 P	5 P–F	6 F	7 F–G	8 G	9 G
10 G	11 G	12 G	13 G	14 G	15 G	16 F
17 F	18 F–P	19 F–P	20 P	21 F	22 F–G	23 G
24 G 31 F–P	25 G	26 G	27 G	28 G	29 G–F	30 F

Sept. 1986
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73® Amateur Radio

Issue #312
A WGE Publication

Sky Wires!

12 Hot Antenna Projects

Including:

- Slinkies at HF — p. 52
- 90-Foot Rotatable Tower — p. 28
- Coaxial Stub Tuning — p. 54
- Feeds for 10 GHz — p. 46
- Scale-Model Antennas — p. 40

Lossless Wireless — p. 60

Worm-Warmer 75m Quad — p. 66

Simple 9-Band Doublets — p. 32

Money-Saving Home-Brew Traps — p. 56



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Watts My Line
Coax, parallel feeders, or microstrip, this Basic program lets you design your own custom transmission line. K4IPV 36

Scaling the Wet Noodle
Antennas in one-quarter time: Experiment with your favorite 160-meter kludge on 40 meters. W5RRH 40

The Missing Link
Control your entire HF station from the convenience of your HT's tone pad. WB2REM 42

Dishing It Out On 10 GHz
Microwave feed systems and antennas that really cook. WB6IGP 46

High and Dry
You'll literally go through the roof over this beam mounting scheme. WA2OLZ 50

The Ramada Radiator
It fits in a suitcase, covers all bands, and costs under $10 to build. WA8WVF 52

The Texas Tango Antenna
Get two bands for the price of one with a tuned-coaxial-stub dipole. K5BTV 54

Trap An Amazon Aerial
In the jungle, there are no Radio Shacks. Here's how to home-brew your own traps. WB4YOD/PW8ZAF 56

Resonant Wire Antennas
Amateur radio's roots: Take a piece of wire and stick it in your rig. (Well, it's a *little* more complicated than that . . .) W0VM 60

The Lazy U Dipole
Here's what happens when a dipole gets the bends. VE7BS 64

The 75m Laid-Back Quad
What started as a joke ended up being a blockbuster antenna. N4VD 66

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73 Amateur Radio®

SEPTEMBER 1986 ISSUE #312

A Rotatable *What?* **28**

There's this 90-foot crank-up tower, see, and it has everything on it, from stacked 23-element yagis for 1296 MHz to a 3-element 40-meter monobander . . . but the wind load's too great to use a commercial rotator. The solution? Easy—put the 90-footer on a lazy Susan and spin the entire tower!

HF Antennas: All Bands, All Wire **32**

The curse of coax is lifted! WØVM vanquishes the black snake with three 9-band antennas. The secret is the use of balanced tuned feeders, a technique all but forgotten by hams who grew up with RG-58U.

Watts My Line **36**

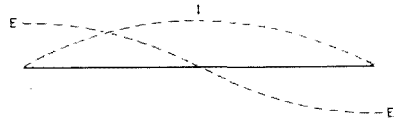
Comes a time when every ham is put to the test. In this case, a nonstandard transmission line had to be fabricated from the materials at hand, a task made easier by the friendly computer. Use this Basic program to design your own lines: coax, parallel feed, shielded parallel feed, and microstrip.

Scaling the Wet Noodle **40**

Bring your next antenna project down to size: Work with a scale model before you erect a full-size skywire.

Dishing It Out On 10 GHz **46**

Construction techniques for building microwave feed systems and antennas, including the serendipitous "plastic baggie" dielectric resonator.



High and Dry **50**

Here's a new twist on the old plumber's delight theme: WA2OLZ describes how to bring your rotator inside the house, and how to erect a 3-element tribander without using a tower.

The Ramada Radiator **52**

A pack-it-up-and-take-it-with-you antenna that works on all bands and costs under $10 to build. (The title of this article came in a sudden flash of brilliance from Managing Editor KA1MPL, whose cousin is known throughout the Midwest as "Ramada Rudy.")

The Texas Tango Antenna **54**

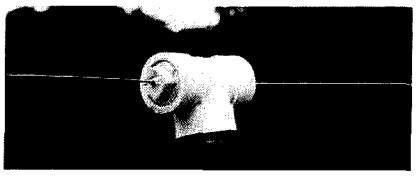
We toyed with the title "The Five O'Clock Shadow Doublet" for this little gem, because of the little black stubs of coax that act as tuned traps in this multiband wire antenna. It's a great way to add the new WARC bands to your favorite dipole.

Trap An Amazon Aerial **56**

Another variation on the trapped dipole, this time with home-brewed capacitors. The prototype for this design was used extensively in the jungles of South America; you can expect years of use here in the states.

Resonant Wire Antennas **60**

Get back to ham radio's roots with a resonant wire antenna—there's no feedline loss since there's no feedline.

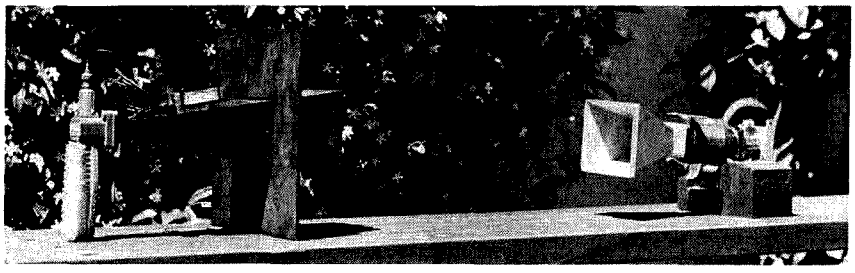


The Lazy U Dipole **64**

The continuing evolution of the VE7BS bent dipole. Basically a single-band antenna, the Lazy U could be just what you're looking for on 160 meters.

The 75m Laid-Back Quad **66**

Okay, maybe the idea of a two-element quad pointing straight up seems a bit odd, but consider that, at least with rf, most of what goes up eventually comes down. (If nothing else it will keep your lawn free of snow in the winter.)



Extra copies of this issue are available for $4.50—send a check or money order to *73* Back Issues, WGE Center, Peterborough NH 03458-1194.

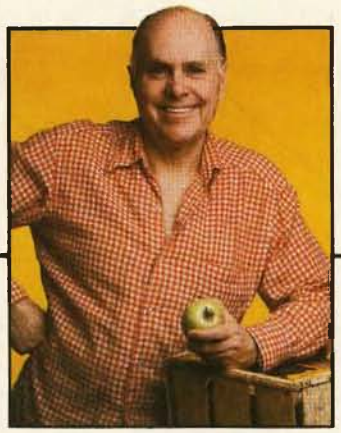
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NEVER SAY DIE



GETTING THE WORK YOU WANT

You say you're not excited and raring to go when you go to work in the morning? If your work isn't fun, you're in the wrong work. If you're not getting to work early so you can get at it. . . if you're not one of the last out at night because you hate to leave, you're losing out on a lot of the fun of life.

Work is fun for millions of people. Work is misery and aggravation for millions more—millions who just have never stopped for a while to think things out. If you leave your life entirely to chance and make no effort to plan it, then you have no beef. Anyone so lazy that they won't make an effort to make life better for themselves should shut up and take life's beatings passively.

What's this got to do with amateur radio? A lot, good friend. Now, just the fact that you've managed to get your ham ticket sets you apart from the average schmo (Yiddish for a foolish or stupid person). However, if you're whining about the cost of ham gear or the cost of a *73* subscription, it's time for you to take stock of your life. If you're short of money you're not doing it right.

Considering all the potential amateur radio has provided you for developing a career—unless you Bashed your way in and really don't know diddly—you should be able to do very well. Electronic technicians are desperately needed today.

But no matter what your field of expertise. . . say, you *do* have some expertise, don't you? If not, that's a big part of the problem. If not, for heaven's sake take some aspect of amateur radio and become an expert on it. It isn't difficult. I've become an expert on NBFM, SSB, repeaters, RTTY, computers, and so on. If I can do it, so can you.

Once you're an expert you can use that to further your career. How do you know when you're an expert? Well, you'll know. It's when you can work from experience and facts rather than firmly held convictions. It's when you get published.

Speaking of being published . . . as a good general rule, when you're changing jobs you'll find that each article you've had published in your field of expertise will bring you about $1,000 a year more in salary. I'll bet that got your attention!

Okay, let's say you've picked a career path where your experience in amateur radio will help you. Let's say you've become an expert on something. . . perhaps slow-scan television. . . or packet radio. Now you want to use that expertise at work. Once you find a company doing the sort of thing you're interested in, how can you get a job there?

No matter what job you want, if you know you're really qualified and that the firm will benefit by hiring you, you can get a job. I don't care if there are no job openings. I don't care if the firm has a hiring freeze. If you want to work there and you spend some time planning your approach, they're dead meat.

The simple, but least productive, way to get a job is to walk in and apply for it. If you've come at the right time they may have an opening. Fine, but unless that opening is just what you're looking for, you're going to be stuck doing something other than your dream job.

It's not all that difficult to get the job you really want, whether the firm knows it needs you or not. All

Continued on page 10



"We heard you have a ham radio outfit on board so we're going out of the way to a rare island from which nobody has ever broadcast!"

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QRX . . .

EDITED BY PERRY DONHAM KW1O

220 Try

ANOTHER ATTEMPT to garner space on the amateur 220-MHz band has been made by the **Association of Radio Reading Services (ARRS)**. The ARRS is a volunteer organization that currently uses commercial FM subcarriers to broadcast text to the reading-impaired. Recent changes in the rules governing subcarrier use make it easier for broadcasters to deny space to groups such as the ARRS; the remaining stations are charging more and more for the use of their transmitters. The ARRS is asking the FCC to set aside ten 50-kHz channels in the amateur 220-MHz band for the reading service. Transmitters would be limited to an output of 1,000 Watts, and antenna height would be restricted to 1,000 feet. The allocation would be primary, with amateur radio coexisting on a secondary, noninterference basis. In an interview published in *220 Notes*, Robert Watson W0YOC, one of the authors of the proposal, said that the idea to use 220 MHz was originally put forth by the NTIA, a group currently involved with the FCC in a joint study of the future of the 220-MHz band. Watson went on to say that the ARRS had conducted an informal survey of the level of amateur activity on 220 MHz, and that on the basis of that survey felt that the ARRS and ham radio could share spectrum. The ARRS feels that theirs is a service very similar in nature to the public-service role played by amateur organizations. The ARRS proposal (RM-5434) joins the growing list of petitions seeking space on the 220-MHz band, including PR Docket 86-161, the Novice Enhancement package. No action is expected on any of the pending petitions until the joint FCC/NTIA study is completed. PR Docket 86-161 should be acted upon before year's end, but only the 28- and 1,296-MHz portions will become effective. . . it could be years before the situation on 220 MHz is straightened out. If you'd like to comment on the ARRS proposal, you can file informally by sending a letter, or you can file formally by sending an original and 12 copies to the commission. If you opt for a formal comment, you also need to send a copy to J. Brian DeBoice, Cohn and Marks, 1333 New Hampshire Ave. NW, Suite 600, Washington DC 20036 (DeBoice is the attorney for the ARRS). You'll also need to include an affidavit with your material stating that you have forwarded copies to Cohn and Marks. The FCC's address is 1919 M Street NW, Washington DC 20554. (An example of the format to use appeared on page 89 of the July, 1986, issue of *73*.)

Ten Matters

BOB HEIL K9EID has proposed changes in the ten-meter FM band plan. The new plan calls for ten repeater pairs on 400-kHz splits and 20-kHz spacing with inputs from 29.100 to 29.280 MHz. 29.300 to 29.400 would be used only for simplex contacts, while 29.400 to 29.500 MHz remains reserved for OSCAR mode-A downlinks. (Eventually, mode-A use will be discontinued, and the space used for simplex operation.) Bob suggests a 50-Watt limit in the repeater subband. Things are pretty quiet on ten meters right now, but as cycle 22 picks up steam, the need for some sort of spectrum management will become more urgent. One of the biggest changes to the present structure made by Bob's proposal is the elimination of half of the AM window (29.000 to 29.200). If you have any thoughts on the matter, please send a note to Bob at PO Box 78, Marissa IL 62257, with a copy to Iowa Repeater Council president Dennis Crabb WB0GGI, 1306 4th Avenue North, Denison IA 51442.

Bird Books

TWO POPULAR BOOKS on commercial satellites have been updated. The second edition of ***The Hidden Signals on Satellite TV*** adds 60 pages of text and two new chapters covering Ku-band reception. The book is available from Universal Electronics, Inc., 4555 Groves Road, Suite 3, Columbus OH 43232. Weather-facsimile fans should pick up the new third edition of Dr. Ralph Taggart's ***The Weather Satellite Handbook***, now published in a plastic binder to make updates simple. This is about the best book going and covers everything you need to know about receiving WEFAX. You can get a copy right from Ralph—send $12.50 to Ralph's callbook address. Ralph has agreed to conduct a weather-satellite column in *73*; it'll be starting next month.

Radio Cops

A NEW VERSION of the Electronic Communication Privacy Act has been unanimously voted out of the House Judiciary Committee. The revised bill, HR-4952, clearly stipulates that it is *not* a crime to simply receive a signal, whether the reception was intentional or not. The language seems to be a little closer to the existing privacy statute which forbids divulging the content of a radio signal. There *are*, however, some pretty puerile items in the bill. Certain types of communications (including cellular telephones, encrypted services, and common-carrier transmissions) are considered "protected" under the bill since they are not designed to be accessible to the general public. HR-4952 spells out the fines and sentences to be imposed upon anyone who tunes in to this type of radio signal. It's easy to look at something like this and laugh. . . the whole idea is really ludicrous. *But*, there is an *enormous* amount of pressure from the communications industry, especially the cellular people, to get this bill pushed through Congress. There is a very real chance that they will succeed. Obviously, if the bill passes, there won't be radio police running around with DF gear—the provisions of the legislation would be extremely hard to enforce. Still, the idea that, for the first time, the government would tell us what we can and cannot listen to should be enough to get you to write your representatives in Washington. Put down the magazine and do it *right now*. It's been about two months since this story was written, and a lot can happen in two months. . . let's hope it's not too late.

Kiwi Flys By

73's own Kiwi correspondent, **Des Chapman ZL2VR**, traveled through scenic Hancock recently to visit the palatial editorial offices of *73*. Des (pronounced Dez) arrived as we were in the middle of an internal reshuffling of desks—in other words, the normally eighth-wonder-of-the-world-like editorial section looked as if an earthquake had just hit, with the epicenter being the desk of KW1O (who was conveniently out of town). We repaired to the Hancock Inn to wash away the dust of the road and get acquainted in person. Des is our kind of DXer, a man who would rather talk to someone on the air than "work" him. We learned much in a short time about New Zealand—not politics or the like, but more practical information like how to buy a round of beer ZL style (just say "It's my shout."). Des has been a faithful provider of ZL news for our *73* International section for a number of years, and it was a pleasure and an honor to meet him in person. Thanks, Des, for your fine work, and when you come this way again, remember that it's our shout.—*KA1MPL*.

Elmer Bank

TWO NEW BANKS have been opened by the **Westchester (NY) Emergency Communications Association**. The programs are designed to help newly licensed hams find their way around their new hobby. The Equipment Bank is a stockpile of surplus gear monitored by Bob Steinberg WA2KHR. Bob contacts new hams in the club to determine what they need to get on the air; when a need matches something in the bank, the equipment is loaned for 90 days. Once a station is set up, new amateurs can contact Adam Weiss WA1WMZ at the Elmer Bank to get paired with an experienced ham who gives the newcomer personal attention and aid. If you'd like more information about WECA and their banks, drop them a note at PO Box 131, North Tarrytown NY 10591.

Fake Out

DON'T BE SURPRISED if in October you hear enormous pileups on what seems to be a U.S. Extra-class license. From October 20th to the 25th, the **Radio Club Mar del Plata** will operate **AZ1D from Trinidad Island** during the ninth IARU Region II conference to be held in Buenos Aires. Trinidad Island is situated about 30 miles south of Bahia Blanca on the Argentine coast. On CW, look for AZ1D on 3.510, 7.005, 14.020, 21.020, and 28.020. On SSB, the operation will be around 3.690, 7.090, 14.200, 21.300, and 28.600. The group also plans to be active on six and two meters (50.110 and 146.52/144.30) and on OSCAR 10 (if it's working).

Time Tip

IF YOU'RE HAVING TROUBLE receiving WWV, you can get accurate time information by calling the National Bureau of Standards on the landline at (303)-499-7111. Don't forget that at 18 minutes past the hour, WWV transmits current and predicted propagation conditions.

I Like Eico

JOHN HODGE called to say that he loves his Eico three-band transceiver, and also that he had successfully tracked down Eico in Hampstead, New York. I had thought that Eico was belly up, but according to John that's not the case—in fact, he placed an order for several items he needed for his rig. Their address is 113 Fulton Avenue, Hampstead NY 11550, or you can call them at (516)-485-1331.

Deeply Asleep

OSCAR 10 IS IN DEEP DOO-DOO. The memory fault that crippled the satellite earlier this year has gotten worse, and attempts to write around the damaged areas have not been successful. Speaking with the *Westlink Report*, AMSAT president **Rip Riportella WA2LQQ** said that the engineering team working on the problem "had been looking for reasons to be optimistic [for the craft's recovery], but frankly had not found any in recent days." As reported last month, the newest Phase 3 satellite is on the ground, waiting for a launch opportunity on the European Space Agency's new Arienne-4 booster. ESA's space activities were squelched when an Arienne-2's third stage failed to ignite, causing the destruction of the booster and the $55 million Intelsat V satellite. Launches will resume as soon as the accident has been fully investigated—some sources fear a two- or three-year delay, although AMSAT is confident that Phase 3C will be launched in 1987. In the meantime, bird watchers will have at least one new spacecraft to play with, the Japanese-built JAS-1 scheduled for launch on July 31; rumors also abound concerning the imminent launch of two new circular-orbit Soviet satellites, RS-9 and RS-10.

Check Writing

A FEW PEOPLE have been asking about the Reader Service cards that appear in each issue of *73*. Here's how they work: When you see an advertisement for a product that you would like to receive more information about, look in the ad for a small check mark followed by a number (it's usually close to the company's name). This is the number to circle on the Reader Service card. We have a pair of wonderful ladies here who'll send your name and address on a mailing label to the manufacturers you've selected. Pretty simple, eh? While you're in the filling-out mood, complete the Product Report Card and the Feedback survey and drop them in an envelope along with your QSL order and your check for $19.97 (for a one-year subscription); you could also toss in a letter to the editor, and get the maximum value from your 22-cent stamp.

Help

HELP WITH THIS MONTH'S QRX came from The *Westlink Report*, The *W5YI Report*, *220 Notes*, *Sweden Calling DXers*, and Rich Moseson N2BFG. Please send your news bits and pictures to *73* Magazine, 70 Rte. 202 N., Peterborough NH 03458, Attn. QRX.

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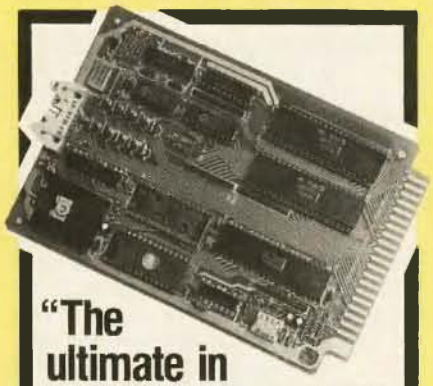
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NEVER SAY DIE

from page 4

you have to do is create your job...defining it to fit your abilities. How? Well, if you do some homework...and presumably, if you really want to work for the firm, you must know something about it...if you find out some weaknesses the firm has...there may be a weakness you can solve for them.

Make sure of your facts, then go to the boss...not the personnel department...and show him (or her) how you will be able to help the firm to make more profits. Your salary will be unimportant if you can solve a problem for the boss. Make sure you're on firm ground with your recommendations.

You can find out a lot about a firm by reading the local papers...reading the trades... and then by getting to know some of the people working there and getting their support. They'll know where the problems are and what's been done so far to solve them. They'll know where you might fit in to make things better.

Once you're in and effective, you want to keep your eyes open for managerial opportunities. If you've been doing your homework...learning about management, advertising, finance, planning, computers, spreadsheets, writing, speaking, etc., your combination of management and technical skills will put you into a position to make real money. And management is where the money is.

If you prefer to be an entrepreneur, you still are going to need both management and technical skills. Indeed, 90% of small businesses fail in the first five years for a lack of management skills. Management is no more intuitive than engineering. Management takes learning and practice.

I've had a lot of hams write to me or approach me at hamfests and say they'd like to work for me. I can't think of any yet who came to me with a plan for making money for Wayne Green Enterprises. They've all had in mind making money for themselves and it really never occurred to them that if they make money for me, they'll make money, too.

When a prospective employee starts asking me about the benefits, I know he's thinking of vacation days, sick leave, and all those things that are going to cost me money without providing me with any benefits. What I want to know is what are the benefits I'll get by having this person working for me. Will he make *73* more fun to read and thus perhaps bring us more readers? Will he be able to help us put out better subscription solicitation letters and thus increase circulation? What are the benefits to *73*? I can't remember anyone ever giving this any thought when they were applying for work.

When you go for a new job, are you more interested in what you can do for the firm or in what kind of insurance plan they have for you? Do you worry about how often they review people for salary adjustments or how you can bring them more business? You know the answer...and I'll bet it's why you're not making nearly as much as you could be.

One of the most basic elements of salesmanship is pointing out the benefits of what you're selling. The most important product you have to sell in the whole world is yourself. So what are the benefits you provide? Once you start thinking this way you'll start seeing ways you can benefit your company more. You may see opportunities to learn more about something and help your company that way. If you think in terms of benefitting the company instead of benefitting yourself, you've made the first major step toward being a real success in life.

We have one of the best places in the world to work here at WGE ...great people...the most modern magazine publishing plant possible...enormous growth potential...good pay... one of the most beautiful parts of the country in which to work and live...a smoke-free environment...opportunities to learn and develop skills in current or new projects...yet even here we have some people who are wasting their lives by not taking advantage of what's available. How many of the opportunities available to you where you're working are you really using?

I had one chap we hired to start a new business for WGE. He was hired at a very good salary, we bought him a home, gave him assistants and a car. Despite all urging, he spent months planning and got nothing of benefit done. When our patience finally ran out and he was replaced by a new one-man department which promptly got the business going, he was furious with me...instead of with himself.

Many of our activities in amateur radio provide us with the expertise to do commercial work. Hams who get into building and repairing of ham gear are naturals for two-way businesses. Hams who get into computer repairs are desperately needed by computer repair outfits. I've recently mentioned the potential in home and business security firms.

Many ham developments can be escalated into commercial products for the entrepreneurially minded. A recent application of slow scan turned up at the Chicago Consumer Electronics Show ...a unit with a camera and monitor which sends pictures over telephone lines. How long before we start seeing commercial packet-radio applications?

Not a few hams have escalated their interest in OSCAR into home satellite sales. That business is in a turmoil right now due to the recent scrambling of signals, but I suspect we'll see some creative solutions to that...probably from a ham.

Maybe you should flag this part of my editorial and re-read it again in a few weeks.

THE AGONY OF SLOW SCAN

Slow-scan television looks like it sure should be fun. Imagine, being able to see snapshots of the chap you're contacting...a picture of his shack...his house. Wowl

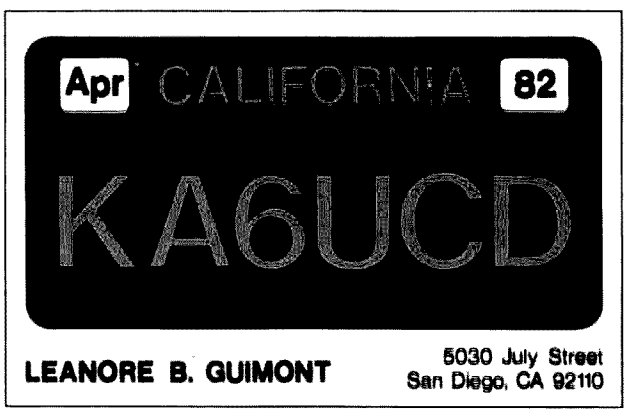
Well, of course there are some downside aspects of slow scan, but there are a lot of wows too. There seem to be enough fun aspects to SSTV to keep the 14.230–40 channel fairly active every day.

I got interested in slow scan in its early days, about 15 years ago. I seem to enjoy pioneering on the ham bands...getting very active on NBFM in 1946, RTTY in 1949, repeaters in 1952, and so on. The camera and monitor for slow scan aren't exactly for paupers, so it isn't a branch of the hobby one gets into casually.

With the camera and a monitor I was in business. Of course I already had a fairly substantial 20m station...as key an element in making dependable SSTV contacts as in any other. I recommend the usual sideband transceiver, kilowatt amplifier, and three-element (or larger) beam up 75 feet on a tower. The usual for DXing or contests.

I set up a restaurant menu board on an easel so I could focus the camera on it. On this I put my call, with a place for calling CQ or confirming the call of the chap I was working. When I'd make a contact, I'd get out the call letters of the chap I was working to snap on the board. That was my QSL.

I also set up a small 35mm projector and a video converter unit...a small mirror with a frosted screen for projecting slides so you can put them on video tape. I'd swing my camera from the menu board to me sitting at the operating desk to the converter for slides of the shack, the house, my



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

daughter Sage, and so on. I worked up quite a series.

Unless you're set up for color SSTV, you'll do better to buy some positive black and white film and shoot your material in black and white. Color slides don't do well when sent in black and white. The gray scale is screwed up.

Being a recognized amateur radio fanatic, I naturally went on to get a second camera so I didn't have to get up and swing it between frames.

There are two major problems with slow scan. One is the amount of thought and work it takes to come up with an interesting program to send. Remember, you can send your program to each chap you work only once. The next time he's not going to be interested in seeing the same old stuff again. So what do you do for an encore? Along about the third contact with a station you're finding the pressure for new programs getting to you. You're running out of ideas... and then soon you're running out of people who will call you. Next you run out of hams who will even admit they can hear you.

The second misery is the other chap's programming. How many times do you want to sit and watch pictures of his kids, his dog with earphones on (DX hound... get it?), his messy shack, and, perhaps worst, fat, ugly him? It's fortunate there are so many SSTV-ers, so for a few weeks you have a good selection of chaps to contact. But then it begins to thin out... the same stations... the same pictures as you tune up and down the band. Hmmm, Playboy centerfolds, so that has to be that YV5. Old girlfriends and pinups... that's the W4 in Miami.

I once ran a slow-scan program contest and got quite a number of creative programs submitted on cassettes. I put the best of them together on one tape and made it available. It wasn't exactly a profit center for the magazine, but it did pay for the trouble... and I think it helped give slow scanners some desperately needed ideas. With some urging I might try another slow-scan program contest... any enthusiasm? It'll be interesting to see how much change we've had in the ten years or so since the last contest.

With over a hundred countries available on slow scan, the program problem is not an immediate one. Indeed, if you stick to DXing and don't play around with lengthy programs, it isn't a problem at all. That's like beefing about the lack of discussion topics brought up during contest or DX-pedition contacts.

I expect there are many readers who are interested in knowing what's going on with color slow scan... with high-definition slow scan. Let's see some articles bringing us up to date on the slow-scan frontiers.

HOW TO BE A MISERABLE ROTTEN FAILURE

Surrounded, as we are, on every side by miserable rotten failures, who needs a lecture on how to achieve this dubious undistinction? Yet, at any time in life, no matter how misspent... even a life dedicated to the pursuit of the religious ecstacy of working DX, probably second only in galactic importance to a lifetime spent memorizing baseball statistics ...it is possible to firmly grasp one's bootstraps, pull one's self out of the muck of life, and join the select fleet few who are successful in more than their own eyes.

Without getting into hair-splitting definitions of success and failure, let's use the usual yardstick... dollars. Dollars you control, whether you own them or not. This will get us away from personal judgements... such as my feeling that anyone who really cares whether a *73* subscription costs $20, $25, or even $30 a year can hardly be classed as a success. Is the magazine fun to read? Okay, I want it, here's my credit card.

If you want to drive a crummy car... fine... but if you *have* to, that's something else. That's avoidable.

Okay, let's get right to the heart of what makes someone successful... other than luck. And even luck can be loaded. When people tell me how lucky they think I am, I say sure, and the harder I work, the luckier I get. We sure have a screwed-up language... and some of the screw-ups can give us major problems. Like that term "work." We use that to describe what we do to earn money, using the same term whether we're enjoying what we do or hating every minute of it.

Sure, we do have words to differentiate, but we're lazy about our language... to some degree. But even William Safire isn't likely to say he's going to drudgery. For those of you who don't read much, Safire writes about words.

Well, enough of that... now, let's take a look at what separates the sheep from the goats... the men from the boys (of all ages). We can even get more fundamental than that. What separates man from all other life on Earth? How did man come to win out? We certainly aren't the strongest animal. A short listen on two meters in Los Angeles should convince even the most stubborn that we're surely not the smartest animal. So how'd we win?

We won out by wearing 'em down. There are many animals much faster than man, yet we're able to catch all of 'em in the long run. Man can outrun a horse, an antelope, and even a cheeta. 26-mile races are popular now... heck, Southwestern Indians used to have 100-mile footraces. We don't even make much of a deal of it when someone walks 3,000 miles across the country.

Fine, he's talking about winning marathons and I work in an accounting office... or sell shoes. The formula for success... the formula for failure... they're the same, whether you're selling shoes or winning a marathon. Most of us go through life, making our choices from what is handed us and griping about it. Few even bother to read books on how to be successful. But how can you expect to hit success if you don't even aim at it? Perhaps you've noticed that relatively few people really succeed.

Heck, everyone can't be a success, right? I'm not so sure. I do know that the more people who are successful, the more successful the country will be. For many years Americans made double and triple as much as people in most other countries. No more. Just as Great Britain had the world in its grasp a hundred years ago and now is heading rapidly toward being one of the poorest countries in Europe, so we're seeing America slipping from its pinnacle of power and success, which peaked in the 50s.

Your personal success or failure depends more than anything else on your persistence. Your failure to persist... plus that of 240 million other unpersistent Americans... adds up to America losing out to Japan in one industry after another. The fact that the Japanese are able to come to America, set up factories, and beat the heck out of American-run factories making the same products... beat 'em in efficiency, productivity, and quality... can't be ignored.

How can we apply this concept to our own lives? What can we do differently so we can start being winners? Let's take the accountant as an example. The choice for him (or her) is to go to work every day, do things the same way as he's always done, go home, watch television or go to dinner and a movie... and back to work again the next day. He might even substitute a couple hours on a 75m net for some television... or a couple nights a week bowling.

The persistent accountant is going to be looking for accounting courses he can take to learn some specialties. He'll be reading the latest books and accounting magazines. He'll be working his way into the business management of his firm. He'll be watching for ideas that he can use with his clients to save or make them money.

The enthusiastic accountant will be checking out many computerized accounting systems to see which is best for his clients ...which is easiest for them to use... which can save them more money. He'll set it up and train them to use it. Different types of businesses call for different computer systems.

With some education in financing, he might help his clients get money—arrange bank loans, set up stock and bond deals, or find investment groups and put 'em together. Soon our accountant is attractive as a chief financial officer for a corporation... and from there, if he learns more about handling people and the technology of his business, to president.

Our ancestors had to outlast antelopes to get a good dinner. Today we get our dinners with education instead of running. Running we do just to keep our bodies in shape so we can enjoy life... but it's still the long haul which wins.

You know, if we set good examples for our kids... if we show them with our own lives that persistence wins... I'll bet we'd have far fewer kids griping about how stupid it is to learn the code to get a ham license. Think about it... what have you done to set a good example for your kids? Are you teaching them with a six-pack and a bag of potato chips as you watch sitcoms... or by taking night and mail-order courses?

If you persist in learning more and more about what you're doing, you'll be surprised at how quickly you sail far beyond everyone else around you. When I started *Byte* magazine in 1975, I didn't

Continued on page 82

LETTERS

HELL NO

All my life I have had a problem learning languages. I just can't seem to translate another mode of communication into good old English. This disability carried over into ham radio with having to learn the code.

The ARRL not only avidly adheres to the code requirement, but they demand you learn the code and take the same form of code test that "they took." For four years I struggled to pass the 13-wpm code exam. I bought tapes, took courses, got on the Novice bands and worked thousands of QSOs, but I still couldn't pass the 13-wpm test...that is until last night when I breezed through the 20-wpm test!

About two weeks ago, while practicing code with my C-64, I discovered that if I speeded up the characters to 20 or 25 wpm (but with 13-wpm spacing) I went from 50% copy to 100% copy. Delighted with this discovery, I called one of our ARRL-sponsored volunteer examiners and asked if I could take the test with 20-wpm characters and 13-wpm spacing. The answer I received left me with the impression that our ARRL VE could not walk and chew gum at the same time. He did mumble that I might try clearing it through the ARRL VEC in Newington.

I immediately got on the phone to ARRL HQ and asked to speak with the VEC. His answer was a flat NO. He went on to mumble something about someone called Farnsworth and the Farnsworth Method, but when queried about what this mystical method was he didn't know. When I pointed out that the FCC rules did not prohibit the test in this manner, his response was "well that's the way I took the test," and I should do likewise. I asked who his boss was and could I speak to him. I was told that he was the boss and that was that. I then asked who he took his instructions from at the FCC, and he finally responded Larry Wykard.

I called Larry Wykard at the FCC and asked him if the FCC had any objections to my taking the test with the faster character speed. I was told that as long as it came out to 13-wpm, he didn't care how fast the character speed was.

I then approached our local ARRL VE armed with the OK from the FCC. Not only was I rebuked severely but I was also told to take the exam as the ARRL provided it or get out. He refused to discuss the matter and said he took his orders from the ARRL and didn't care what the FCC said.

I took the exam as provided by the ARRL and flat flunked it. I couldn't copy 40% with the slow character speed.

I then learned that an outfit called W5YI could also give exams...and best of all there was a scheduled exam in two weeks in the next town. When I told the W5YI VE of my problem with the slow character speed, his response was, "What speed do you want the characters sent at?" No hassle, no argument, no problem. I went to the W5YI exam and breezed through the 20-wpm test. It took me about 20 seconds to fill out the answer sheet. The attitude of the W5YI VEs was more than cordial; they went out of their way to help those of us taking the exams. They gave us all the practice code we wanted and waited until all were ready for the test before beginning. They were the most polite and helpful group I have ever run into in ham radio.

About a month ago (before I knew about the W5YI VE program) the ARRL sent me their letter urging me to renew my membership. I was somewhat disgusted with the whole situation and the 13-wpm code test. I was seriously considering quitting ham radio, and I tossed the letter aside. Today I frantically searched for it, found it, and answered "HELL NO."

Jim Shook N4KIM/AG
Ocala FL

Jim, you can't blame the folks at the League...they can't help it if they're stuck with a sluggish bureaucracy. Just about every decision made at the ARRL is made by some sort of committee—a committee which then presents its decision to a board for a vote. Of course, the board needs time to weigh all of the consequences, and, after all, there's no need to just rush into things, right?

Groups like the W5YI VEC can be very accommodating since they're in business to help people get licenses, not to maintain a power structure.

Since you mentioned it, I'd like to point out that the best way to learn code is to start right out at the speed you want to use. If you want to copy 20 wpm, then learn what characters sound like at 20 wpm. That way your brain hears the sound and immediately associates it with a character without any further processing.—KW1O.

WHY THE WAIT?

"Please allow 6–8 weeks for delivery" and the paradoxical parenthetical expression "(We're computerized for speed)" somehow seem grossly inconsistent with your 12-page subscription mailing. I had the card filled out—which incidentally didn't fit the envelope provided—a check enclosed, and the envelope sealed, but became increasingly uneasy about the inconsistency, to me, between the handling of a new subscription and what you "say," and how you "say" it, in 12 pages. I read it all and don't believe I've ever read that much from anyone else who wanted something from me.

Why do most suppliers of mail-order items want 4–6 weeks, and you want 6–8 weeks, to get something delivered? Or to change a subscription address?

I'm sitting on my sealed subscription envelope for a while.

Preston B. Tack N6MXJ
Desert Hot Spring CA

Most mail-order houses will sell things to anyone who sends them money. Here at 73, we're a bit more discriminating—after all, we can't let just anybody read our magazine! Once we receive your application for subscription, it takes about 6 weeks to check you out with the FCC, your local radio club, and your third-grade teacher. (If you haven't heard from us in 6 weeks, start looking over your shoulder.)

As they say, many call, but few are chosen.—KW1O.

PRICE OF HAM

As a non-ham, I'd like to complain about the ticket prices charged at hamfests. It seems to me that the money should be used to cover a club's expenses in presenting the event as well as to make money for other club functions. However, much of this money is used to buy the prizes offered for the hamfest.

From what I've seen, the people winning the main prizes are those that already have a similar piece of equipment, and rather than selling the old set and keeping the new one, they try to sell the set they won.

Another thing about hamfests that bothers me is when a club states that if a non-ham's ticket is drawn, the club will not give him a transmitter if that is the prize. One club said it is their policy not to allow transmitters to be given to unlicensed people. I can think of lots of instances where a non-ham might want to do something with a transmitting rig, such as keep it for when he does get a license, use it as a receiver only, an XYL could give it to her husband, it could be donated to a club, and so forth. If I get a ticket to a hamfest with such a rule, I just put someone else's name on the ticket.

Another point I'd like to bring up is the cost of getting into a hamfest just to look at most of the same things I saw at the last hamfest. The charges for some hamfests to set up a table to sell are also excessive. Why can't they have a $1 or $2 admission and another $1 or $2 for setting up? I have gone to record conventions and gun shows that were extremely large, yet I was charged $2 at most for admission.

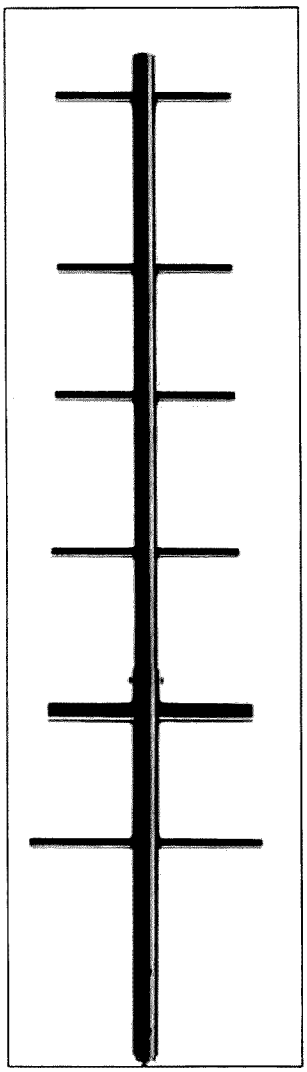
Monty Meier
Apple Creek OH

The most I've paid is $9, which I thought was a real rip-off. Most of the shows I've seen have been worth between $3 and $5...the value is directly related to the size of the flea market.

Restricting certain prizes to licensed amateurs is just ludicrous. A prize is a prize, guys. Besides, what better incentive is there to get a license than to be given a shiny new transceiver? If a non-ham wins, instead of making him feel like dirt, the club should do all it can to help the fellow get his ticket.

Do you know what the real problem is, Monty? It's that hams take their hobby too damn seriously. They're always worrying about little nit-picking rules and feeling self-important about their "hard-earned" licenses—it's no wonder that young people are turned off by such a pompous bunch. I guess that after 20 or 30 years, one forgets how much fun ham radio used to be.—KW1O.

NEW PRODUCTS



Larsen's new 900-MHz yagi.

LARSEN YAGIS

Larsen Electronics has announced the YA5 series of yagi antennas for use in the 806–860-MHz range. The YA5-806 is designed for cellular-radio operation, while the YA5-900 can be used on the amateur 900-MHz band.

The antennas feature all-weather construction: The coax is terminated inside the yagi, and a black weather-resistant coating is applied at the factory. The antennas have a 10-dBd gain, a horizontal beamwidth of 45 degrees, and can handle up to 300 Watts.

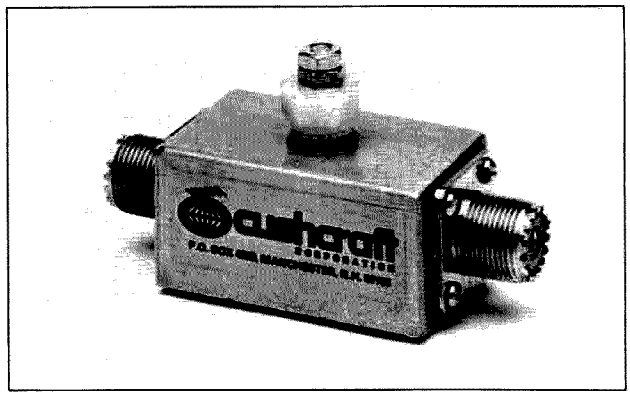
For more information, please contact *Larsen Electronics, PO Box 1799, Vancouver WA 98668; (206)-573-2722.* Reader Service number 153.

NEL-TECH DIGITAL VOICE KEYER

Nel-Tech Labs' DVK-100 is a microprocessor-controlled digital voice storage and announcement system. The DVK-100 is configured with 32 seconds of voice memory divided into four messages of 16, 8, 4, and 4 seconds. Other features include a built-in selectable audio compressor, an end-of-transmission tone, and an amplified local monitor.

The DVK-100 is compatible with all transceivers. Transmitter keying is switch-selectable between positive and negative keying voltage.

For complete details, write or call *Nel-Tech Labs, Inc., 28 Devonshire Lane, Londonderry, NH 03053; (603)-434-8234.* Reader Service number 155.



Cushcraft's new lightning arrestor.

C. ITOH COLOR DMP

C. Itoh Digital Products has introduced a seven-color version of their high-speed 80-column ProWriter C-310 and wide-carriage C-315 dot-matrix printers. The DMPs can turn out color graphics with a density of 240 x 216 dots per inch and support popular software packages such as Lotus 1-2-3, Symphony, GEM, and PC-Paint. Print speeds are 300 cps in draft mode, 50 cps in correspondence mode, and 33 cps in letter-quality mode.

The C-310 ($739) and C-315 ($909) come with a variety of resident character fonts and both an 8-bit parallel and an RS-232 serial interface.

For complete information, contact *C. Itoh Digital Products, Inc., 19750 South Vermont Ave., Suite 220, Torrance CA 90502.* Reader Service number 162.

CUSHCRAFT ARRESTORS

Four new coaxial lightning arrestors are available from Cushcraft Corporation. The models offer a choice of power (200 or 2,000 Watts) and connector style (UHF or type N). Replacement cartridges are available.

For more information on these and other Cushcraft products, please contact *Cushcraft Corporation, PO Box 4680, Manchester NH 03108; (603)-627-7877.* Reader Service number 158.

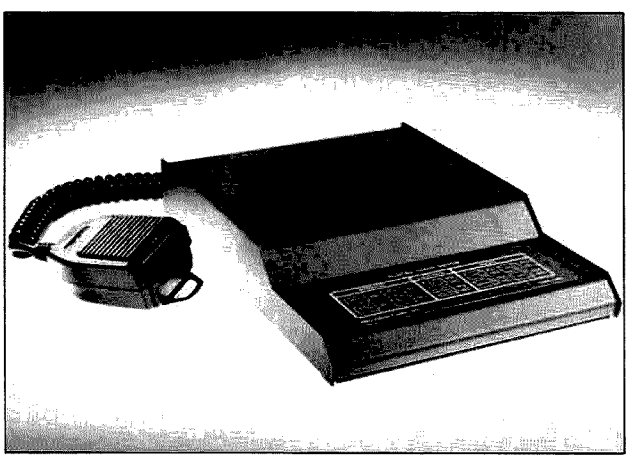
J.S. TECHNOLOGY SINAOAPTOR

J.S. Technology's model SAI-01 Sinadaptor is a pocket-sized unit which turns any VOM into a Sinad meter. The only constraints are that the VOM or VTVM must have a sensitivity of 2.5 V ac or better, and that the meter must have a scale marked in dBs.

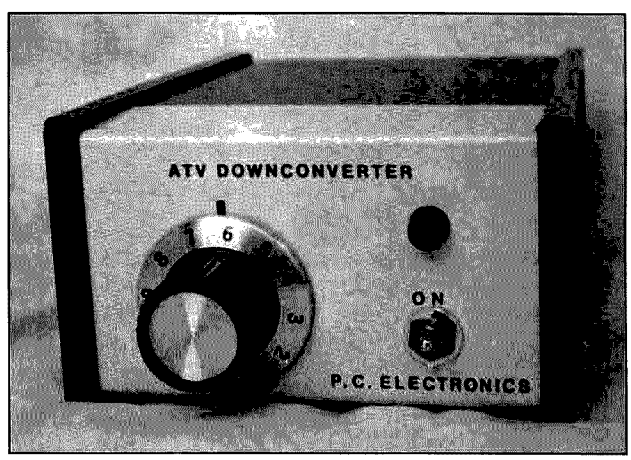
For complete information, contact *J.S. Technology, Inc., 39 Main Street, Scottsville NY 14546; (716)-889-3048.* Reader Service number 156.

GaAsFET ATV DOWNCONVERTER

P.C. Electronics has added a GaAsFET ATV downconverter for



The DVK-100 digital voice storage and announcement system.



900-MHz ATV downconverter available from P.C. Electronics.

the new 900-MHz band to their *line of amateur* television products. A dual-gate GaAsFET is used in both the rf preamp and the mixer stage for low noise and wide dynamic range. Total conversion gain is about 25 dB.

Two models are available. The TVC-9G ($109) comes installed in a cabinet and is ready to plug into an antenna and a television set. The TVC-9 ($69) is for those who want to package their own system (such as a mast mount).

For more information on ATV products, please contact *P.C. Electronics, 2522 Paxson Lane, Arcadia CA 91006; (818)-447-4565.* Reader Service number 160.

ICOM IC-A2 ACCESSORIES

Three new accessories are available for ICOM's IC-A2 hand-held airband transceiver.

The IC-CM28 NiCd battery charger ($19.95) operates from any 28-V-dc power source for use in flight or on the ground. (A 12-V cigarette-lighter cord, the IC-CM1, is available for $14.50.)

An alkaline battery case, the IC-CM12 ($24.95), holds ten AA cells for an output of 5 Watts from the IC-A2.

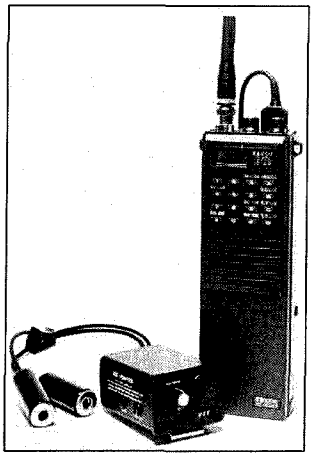
Hands-free VOX operation is possible with the addition of the David Clark Company DC VOX unit ($199.95). The VOX interface is designed to plug directly into a DCCI aviation headset, and can be adapted for use with nearly any standard headset.

For more information on the IC-A2 and its accessories, contact *ICOM America, Inc., PO Box C-90029, Bellevue WA 98009-9029.*

PALOMAR TUNER TUNER

Palomar Engineers has announced the Tuner Tuner™, a device which connects between the transceiver and antenna. A built-in 50-Ohm noise bridge gives an audible null in the receiver when the antenna-matching unit is adjusted properly, eliminating the *need to* transmit into a high vswr while tweaking the antenna tuner.

The Tuner Tuner (model PT-340) retails for $99.55 plus $4 shipping and handling—for more information, contact *Palomar Engineers, Box 455, Escondido CA 92025; (619)-747-3343.* Reader Service number 157.

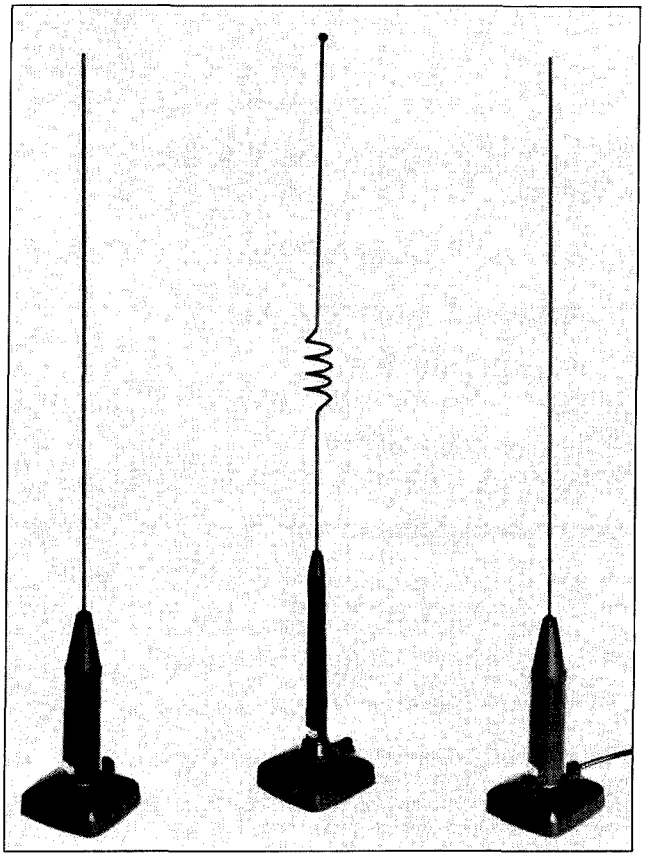


Accessories for ICOM's IC-A2 airband hand-held.

YAESU AD-2 DUPLEXER

Yaesu has announced the new AD-2 Duplexer for the FT-2700RH and FT-726R transceivers. The AD-2 provides for semi- or full-duplex crossband operation with a single 2m/70-cm antenna. Band-to-band isolation is 50 dB; insertion loss is less than 0.3 dB at VHF and less than 0.5 dB at UHF. The AD-2 can handle 50 Watts of rf.

For further details, please write *Yaesu Electronics Corporation, PO Box 49, Paramount CA 90723.* Reader Service number 161.

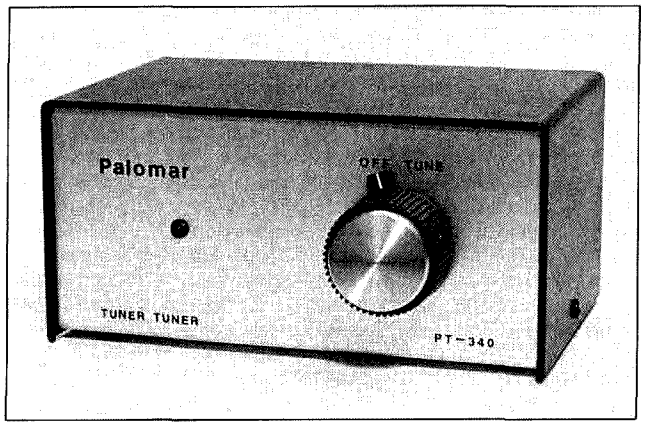


Black Stallion CB antennas from The Antenna Specialists.

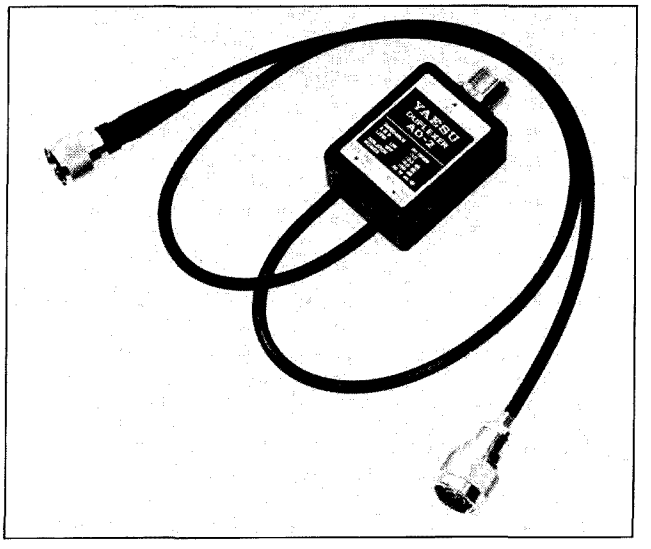
BLACK STALLION CB WHIPS

The Antenna Specialists Company has come up with a new line of mobile CB antennas. Three configurations provide for just about any mounting requirement, including trunk-lip, trunk-mount, and mag-mount. The model M-900 is designed to look like an elevated-feed cellular antenna. All three versions are coated in black Teflon™.

For more details, write *The Antenna Specialists Company, Marketing Dept., PO Box 12370, Cleveland OH 44112-0370.* Reader Service number 159.



Palomar Engineering's Tuner Tuner.



FT-2700RH/FT-726R duplexer allows use of single VHF/UHF antenna.

ICOM IC-1271A 23-Cm Multimode

by Peter H. Putman KT2B

ICOM America, Inc.
2380-116th Avenue NE
Bellevue WA 98004
Price class: $950



Photo A. The ICOM IC-1271A 23-cm multimode transceiver.

Can it be? Have I actually found a UHF multimode radio I really like? Well, I'm not that hard to please. I do enjoy using multimodes, especially when operating portable. It's just that they usually don't compare to a good quality HF radio with transverter ahead of it.

But one thing that multimodes have never lacked is operating ease. Despite their receiver limitations, it's all in one box! That's hard to beat for convenience. And amazingly enough we may be closer to an 80-meter-through-70-cm multimode than we think! The Japanese are moving at such a rapid rate in this area that it was only logical that we'd see a multimode for 23 centimeters before long.

Features

ICOM is the first to break this ground with their IC-1271A transceiver. Designed as a companion to their low-band equipment and IC-271/471 series, it covers 1240–1300 MHz. For example, this is the first unit I've used on 23 cm with VOX, adjustable agc, and a noise blanker (somewhat useless and a real oddity!). I can write up to 32 independent memories into the unit and scan them, or employ two vfo's independently or split as needed. And, I have my choice of CW, USB, LSB, FM, and even ATV modes, all with a GaAsFET front end and 10 Watts of rf output!

Well, almost. The particular unit I tested measured under 10 Watts out. And the GaAsFET front end leaves something to be desired. And the ATV mode is an option. And who uses split vfo's up here, anyway?

Well, on to the nuts and bolts: Those of you who read the June IC-471A vs. TS-811A comparison will find similarities in the front-panel layout of the IC-1271A. As mentioned earlier, VOX, AGC, NB, and MODE controls are identical. A noise blanker at 1296 MHz is almost unnecessary, since all noise generated here comes from the front end, not the atmosphere. The agc is okay to have, but I doubt you'll ever change the setting. VOX is a real strange thing to use up here but fun to play with. You will need it to operate CW, however.

As in all ICOM models, the output power is continously adjustable, a nice feature I wish other manufacturers would adopt. On this particular unit, I connected a Bird Thruline section directly to the type-N output connector and a Bird 25-Watt Termaline to the other end. With 14.0 volts dc measured at the radio, I saw 8 Watts of rf output at 1290 MHz. A Bird 25K slug was used (25 W, 1.1–1.8 GHz). In the low-power position, I measured about 1.5 Watts using the same setup. Both measurements were made in CW and FM modes. Because I was unable to locate a spectrum analyzer that resolved frequencies greater than 1200 MHz, I skipped the output waveform tests and will have to take ICOM's word for their spurious emission suppression claims (better than −50 dB).

Let's get back to the controls. A separate TRANSMIT switch is available, which is a real plus when tuning up the typical 23-cm cavity amplifier. You can also enable the transmitter from the 24-pin molex jack on the rear panel, or in CW with the VOX on. The RF GAIN control functions like all other RF GAIN controls on ICOM multimodes, but you'll never turn it down on 23 cm! Multi-speed tuning rates are also available for the vfo knob, which are 25 kHz/1 kHz in FM, and 1 kHz/100 Hz in SSB/CW mode.

The memory functions are useful. You can memorize the frequency as well as the mode. Then, you can employ the MODE-S switch to scan through only those memories that contain your selected operating mode. Dual vfo's are available, and you can lock the front-panel vfo frequency while dialing through the memories and vice versa. In addition, if repeater operation is contemplated, offsets can be custom written. If desired, an optional UT-15 tone synthesizer can be installed for CTCSS operation.

Other options include an internal switching supply (IC-PS25), speech synthesizer unit (IC-EX310), computer interface (IC-EX309), and ATV interface unit (TV-1200). The latter requires only a VCR and camera on transmit, and television on receive for full wide-band color operation.

The balance of controls includes SQUELCH, although most of the signals worked on SSB/CW are so weak they won't break it, and METER, which switches between an FM discriminator mode and conventional S-meter mode as required. CW DELAY, VOX, and CW MONITOR controls are accessible through the top cover as in other ICOM models. A separate external speaker jack is available on the rear panel if needed. Other rear-panel connections include EXT SPEAKER, INTERFACE (for the EX309), DC POWER, ANTENNA, the same 24-pin molex ACCESSORY jack as on other ICOMs, and finally the TV IF INPUT and TV IF OUTPUT jacks for the TV-1200 accessory. As usual, ICOM includes a very detailed, well-written owner's manual and schematic with the unit.

I assume ICOM put these options into this

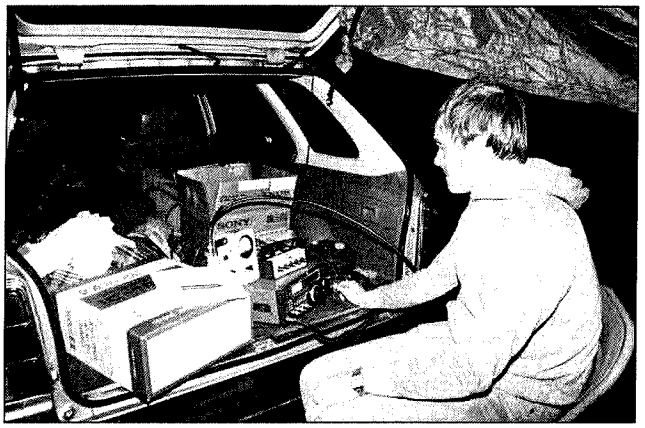


Photo B. KT2B putting the 1271A through its paces in the 1296 Sprint last May. Neither rain, nor snow. . . .

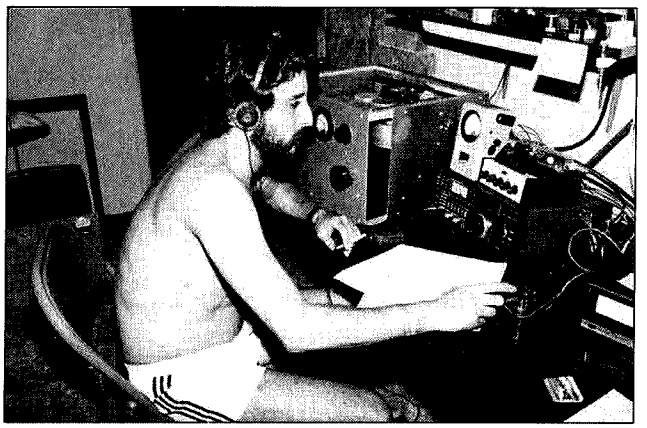


Photo C. WB2WIK using the 1271A during the VHF QSO Party last June. Note the 150-Watt home-brew cavity amplifier to the left.

radio because amateurs in Japan are already busy using these modes. On the other hand, the bulk of 23-cm activity in the United States right now is weak-signal SSB or CW, with a limited amount of FM, ATV, and satellite operation. The vast majority of U.S. owners may never use most of these controls. This could change if Novices gain 1240-MHz privileges, except that the radio runs 5 more Watts than Novices would be allowed to use. Perhaps ICOM will make a modified version of this radio if that happens.

On the Air

It seems that whenever there's a severe drought, all I have to do is decide to operate 432 or 1296 portable from a mountaintop and it rains cats and dogs (Photo B). WB2WIK and I ran the 1296 Sprint from atop Sunrise Mountain in northwestern New Jersey (grid square FN21). We were caught in a large moisture cloud shortly after setting up. The effect of operating into dense clouds at this frequency is well known. Using the unit barefoot, we worked ten stations in four grids, one of which was over 100 miles away in Atlantic City. Our antenna was the F9FT 55-element yagi on 30′ of mast from about 1600′ elevation. With a 13.8-volt battery we measured only 8 Watts output. In this operation, with the high-gain antenna, the receiver gave a good accounting of itself.

I had hoped to run some tests on 23-cm FM from the car, but the companion IC-120 shipped with the review unit had a defective front end and had to be returned to the factory, so my evaluation of the FM performance on the air was limited to using a transverter in the FM mode with my TS-430S. The quality of received audio was good, with crisp response as evaluated on the workbench. Again, the displayed frequency didn't agree with what I measured and was off by about +3 kHz. Signal strength for 20 dB of quieting was in excess of ICOM's claimed spec of 0.32 uV and closer to a microvolt.

Our luck was better during the June VHF QSO Party. Received reports indicated clean audio on SSB and no detectable chirp on CW. The PLL system is stable but not very accurate. When the display indicated we were operating on 1296.090 MHz, the measured frequency was actually 1296.093. In my opinion, this is acceptable at 23 cm since virtually all equipment in use here is off frequency by a few kHz as well. It won't be a problem on FM, as you'll see the presence of a carrier on the signal-strength meter. But you might go nuts looking for a weak SSB signal unless you use the RIT (good for plus or minus 2.5 kHz) or tune the vfo around a bit. Rf output is fairly stable across the range of 1240–1300 MHz, falling to 6 Watts at 1240 MHz.

"It seems that whenever there's a severe drought, all I have to do is decide to operate 432 or 1296 portable from a mountaintop and it rains cats and dogs."

The receiver utilizes a MGF1202 GaAsFET, and ICOM claims sensitivity in the SSB mode to be less than 0.16 uV for 10 dB S+N/N. I'll dispute that, as my SSB Electronics transverter is rated about the same but really does meet the specification. The ICOM appears to be more in the range of .7–.85 uV for 10 dB S+N/N. In fact, it took a really strong local signal which was line-of-sight running 100 Watts to make the S-meter pin hard. As in the case of the IC-471A, the 1271A meets and exceeds its claimed selectivity specs of better than 2.4 kHz at −6 dB in SSB/CW and better than 15 kHz at −6 dB in FM mode.

The radio really needs a preamp for serious weak-signal work. ICOM advises that a mast-mount preamp is available for the IC-1271A, although there isn't much mention of it in the owner's manual. My suggestion would be to employ either an internally mounted unit or a good rf/dc switched preamp, such as the SSB Electronics units. If you choose the ICOM version, it mounts at the mast and the coax feedline multiplexes rf and dc to run the preamp, actuated by the front-panel PREAMP switch.

In our contest operation, we employed an outboard GaAsFET to improve sensitivity. It made a big difference! With it, we worked 18 stations in 9 grid squares, the furthest of which was over 200 miles away. A 3CX100 cavity amplifier was also used, running about 130 Watts to 4 x 23-element Tonna yagis. Having the memory and scan functions is a bonus during contests, since you never can be sure where someone will pop up on the band during a schedule. Some stations who tried to work us were as far as 6 to 10 kHz off the agreed upon frequency!

Conclusion

If you like to run multimodes, the IC-1271A will be a nice addition to your shack for 23-cm operation provided you: (1) use a good-quality external GaAsFET preamplifier, (2) employ low-loss feedline and a high-gain antenna, and (3) have about $900 to spend. Whoa! $900? Yep, every penny of it. This is not a cheap radio by any means, and there's no doubt you can buy a good transverter for half that which will run rings around the IC-1271A. That's also a lot of money for a band that most people use only six times a year during contests.

The key here is activity. Should Novices gain 23-cm privileges and should the price of this unit drop to a more reasonable level (say, 500–600 dollars), ICOM will be sitting in the catbird seat with the 1271A, and it might just open up the band to more users, especially those interested in fast-scan color ATV operation. Although 23-cm repeaters aren't practical for wide coverage in hilly areas, I could see Novices using community repeaters with these units for FM and packet, with occasional forays into the weak-signal modes. But it's great for mountaintop and portable operation, as the 1271A weighs only 14 pounds.

And to think a transceiver like this was just a pipe dream five years ago.■

Heath HO-5404 Station Monitor

by Marc Stern N1BLH

Heath Company
Dept. 011-442
Benton Harbor MI 49022
Price class: $250

How many times have you heard a signal on 20 meters that's so broad and splatters so much that you just had to see it for yourself and, maybe, tell the other operator about it? With the congestion on HF today, the chances are pretty good that you've run into this situation at least once an operating session.

The next question that will probably arise, if you're serious about it, is: "How do I go about it?" If you can afford it, you might consider tying up a lab-grade oscilloscope at a slow sweep speed and a lower frequency response level. But there are few operators who can afford this luxury, especially if the scope is used for other things. The solution, then, is a station monitor, which also can double as a minimal level oscilloscope.

Usually inexpensive enough to be dedicated to monitoring station activity alone—$250—most station monitors add to their utility by offering pan-adapter modules so they will also function somewhat as spectrum analyzers.

Further, station monitor scopes are made to handle station monitoring chores, unlike oscilloscopes whose primary missions are for far more sophisticated chores. For example, the average station monitor scope comes equipped with audio level inputs, while you must use clip leads and, possibly, attenuator pads—if the audio drive is too high—so an oscilloscope can handle station monitoring.

And this brings us to the topic at hand, the Heathkit HO-5404 Station Monitor. It's a unit which is made to be part of an HW-5400 HF station, so it follows Heathkit's relatively recent change to a brown color scheme. Its price puts it in line with other station monitors on the market.

A competent unit, the HO-5404 arrives in two boxes. The first contains the chassis, motherboard, demodulator board, and their associated parts; the second contains the cathode ray tube.

As you first look at it, two things strike you: (1) You wonder why Heath used such a big box for so few components—the chassis is 11-1/4" x 12-1/8" x 1-3/8" and it weighs 10.6 pounds—and (2) you notice that it's an organized kit.

Rather than engaging in its former practice of providing bags and boxes of parts which were arranged in a seemingly helter-skelter manner, Heath has organized everything neatly and logically. Major subassemblies and their parts are grouped together so that everything is easy to find and check.

Once this is finished, the first major assembly is the demodulator board, after which you move on to the motherboard. The demodulator board takes about an hour or so to put together and the motherboard takes another four or five.

If you look carefully as you assemble the kit, you can see there is a subtle pattern in the way the components are mounted. As each wave of mounting washes across the board, you notice the close-mounted items, such as resistors and diodes, are mounted first. Then come the medium-height mounts, such as capacitors. Finally, the transistors are mounted. It does make things more convenient as you stuff the board.

With these items out of the way, you begin to assemble the chassis, with the rear connectors first. These connectors include antenna inputs as well as vertical and horizontal inputs. The attenuator switch and power line also are installed in this area.

After these connectors are installed, you turn your attention to the front of the chassis, which is probably the toughest part of the assembly.

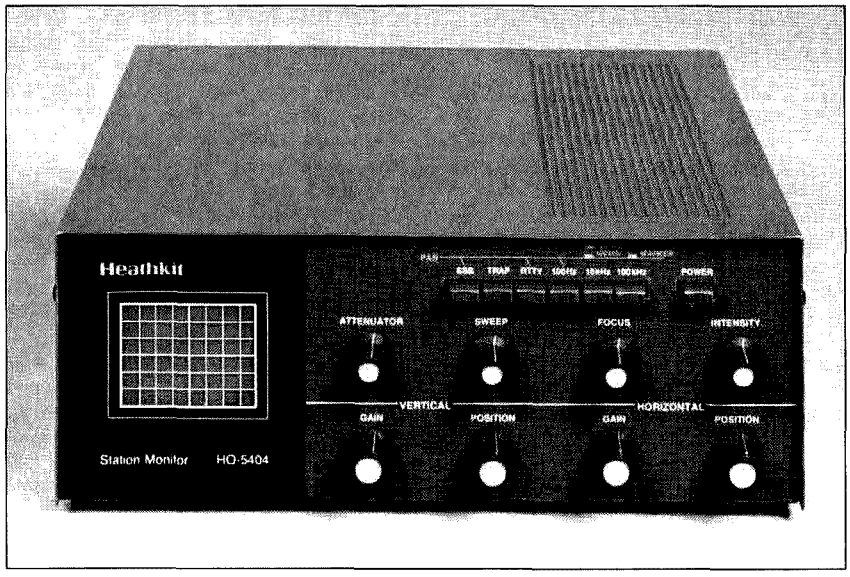
At the front, the first step is installing a huge plastic decal. It not only contains the labeling for various potentiometers and switches, but it also serves as the graticule for the scope. It requires a great deal of care to do this correctly and I'd suggest lining up the work several times before you peel the covering off the back. The glue on the back holds like iron, and once you've put it on there's no turning back. So, if it's crooked, you're in for an interesting time trying to get it off and reposition it. Fortunately, rather than rush ahead, I took my own advice and lined everything up—and placed it on the first try.

"The real strength of the HO-5404 is that you built it and know it thoroughly. You can go in and troubleshoot a problem and replace a bad part."

The decal and the installation of the potentiometers and switches are the easiest steps of the process. Because once you've installed the switches—the motherboard is also installed about now—you must begin to wire them up in place. Not only does this call for care, it also calls for a steady hand with the soldering iron because it gets pretty crowded with wires and other pot-mounted components—capacitors, for example—very quickly. It's also a very tedious job that quickly becomes tiring and, as we all know, tiredness leads to inattention.

Once this is done, you must then wire up the switches, an even more tiring job because it seems like there are twice the number of connections to be made.

Quite frankly, this seems to be a time-wasting, backwards method of mounting and wiring switches and pots. I would urge the procedures to be turned around so that everything is wired up outside the chassis and then installed. This would make it easier for the kit builder, who would be worried only about the length of the leads instead of burning through wires in a jungle of tangled connections with already-installed components. It would also lessen the potential for mistakes because it is possible to attach a wire to the wrong point as the jungle of wires grows. The same is true of the switches.



Heath's HO-5404 Station Monitor.

NEW! Lower Price Scanners

Communications Electronics,™ the world's largest distributor of radio scanners, introduces new lower prices to celebrate our 15th anniversary.

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List price $699.95/**CE price $469.95**
10-Band, 20 Channel • Crystalless • AC/DC
Frequency range: 25-550 MHz. continuous coverage and 800 MHz. to 1.3 GHz. continuous coverage.
The *Regency* MX7000 scanner lets you monitor Military, Space Satellites, Government, Railroad, Justice Department, State Department, Fish & Game, Immigration, Marine, Police and Fire Departments, Broadcast Studio Transmitter Links, Aeronautical AM band, Aero Navigation, Paramedics, Amateur Radio, plus thousands of other radio frequencies most scanners can't pick up. The *Regency* MX7000 is the perfect scanner to receive the exciting 1.2 GHz. amateur radio band.

Regency® Z60-GS

List price $299.95/**CE price $179.95/SPECIAL**
8-Band, 60 Channel • No-crystal scanner
Bands: 30-50, 88-108, 118-136, 144-174, 440-512 MHz.
The *Regency* Z60 covers all the public service bands plus aircraft and FM music for a total of eight bands. The Z60 also features an alarm clock and priority control as well as AC/DC operation. Order today.

Regency® Z45-GS

List price $259.95/**CE price $159.95/SPECIAL**
7-Band, 45 Channel • No-crystal scanner
Bands: 30-50, 118-136, 144-174, 440-512 MHz.
The *Regency* Z45 is very similar to the Z60 model listed above however it does not have the commercial FM broadcast band. The Z45, now at a special price from Communications Electronics.

Regency® RH250B-GS

List price $659.00/**CE price $329.95/SPECIAL**
10 Channel • 25 Watt Transceiver • Priority
The *Regency* RH250B is a ten-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to ten frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH250 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH600B** is available for $454.95. A UHF 15 watt version of this radio called the **RU150B** is also available and covers 450-482 MHz. but the cost is $449.95.

NEW! Bearcat® 50XL-GS

List price $199.95/**CE price $114.95/SPECIAL**
10-Band, 10 Channel • Handheld scanner
Bands: 29.7-54, 136-174, 406-512 MHz.
The Uniden Bearcat 50XL is an economical, hand-held scanner with 10 channels covering ten frequency bands. It features a keyboard lock switch to prevent accidental entry and more. Also order part # **BP50** which is a rechargeable battery pack for $14.95, a plug-in wall charger, part # **AD100** for $14.95, a carrying case part # **VC001** for $14.95 and also order optional cigarette lighter cable part # **PS001** for $14.95.



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List price $369.95/**CE price $239.95**
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Bands: 29-54, 118-136, 144-174, 406-420, 440-512 MHz.
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List price $349.95/**CE price $203.95/SPECIAL**
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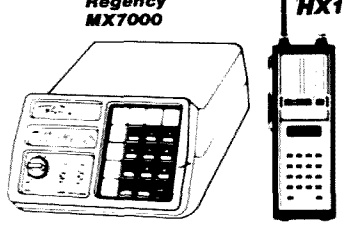
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Frequency range: 29-54, 136-174, 420-512 MHz.
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With all of this done, the final step is installing and wiring up the CRT and connector. This, again, is straightforward, although it does pay to take care not to handle the CRT too roughly to limit chances of breaking it.

At this point, you're ready for the tuneup which also is straightforward and simply involves balancing the vertical and horizontal amplifier sections. This involves setting a couple of pots on the motherboard so that the circuits are balanced at 80 volts. It was at this point that I began to go somewhat gray as I kept on trying to get the vertical circuitry balanced and it wouldn't. Each time, one side would be at 80 and the other would be at 137, and when I adjusted the other side, the first would be out of adjustment.

Checking things out, it looked as if one of the driver transistors in the amplifier section was bad—Q104 and Q106—and I called customer assistance.

As I explained what was going on to the customer assistance rep, he quickly diagnosed the problem—Q104—and transferred me to the parts department where he had already ordered the new part to replace the offender on the motherboard. All I had to do was give my name and address. Less than a week later, the part arrived; I installed it, and everything was aligned quickly.

The acid test came when I put it on a rig and fired it into the dummy load. After adjusting everything according to instructions, I keyed the microphone and everything appeared as the documentation said it would.

I then went on to monitor my radioteletype signals, packet signals (just to see what they looked like), CW signals, and phone signals. As I watched the phone signals, one thing became clear to me: Too many operators have their speech compressors cranked up way too high and their signals are splattering all over the place. Nearly every signal I looked at on 75 was flat-topped and splattered everywhere.

The strength of the Heathkit HO-5404 Monitor Scope isn't so much that it will serve as a good station monitor for VHF (1.8 to 54 MHz) or even as a reasonable 5-MHz scope (10–40-kHz vertical response and 10–300-Hz horizontal response) for bench purposes. It's a strong performer in both roles and is easy to use since there are only seven switches and eight pots in front, some of which you set once and forget.

The real strength of the HO-5404 is that you built it and know it thoroughly. You can go in and troubleshoot a problem and replace a bad part. This is possible because the scope uses discrete components rather than Very Large Scale Integration techniques. It is probably one of the few kits on the market that isn't stuffed full of ICs that you can't work on.

Another real strength is its documentation. Not only does it lead you step-by-step through the scope's construction and alignment, but it also guides you through troubleshooting procedures and gives suggestions should a problem arise. It also has a theory-of-operation section that explains precisely how the scope works, which is a refreshing change in this day of appliance manuals.

Further, the manual gives you valuable examples of the types of scope patterns you will see given a certain set of conditions (chirping, splattering, flat-topping, for example).

Despite these strengths, there is a sobering thought that occurs to me and that is cost. Operators used to build kits because they were less-expensive alternatives to over-the-counter gear. But with Heathkits costing nearly the same as fully assembled gear, it makes you wonder why an operator would build instead of buy.

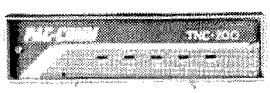
In my case, I feel a sense of satisfaction, but I can't say that I've learned anything from it, other than how to stuff a board. I also am familiar with the innards of the gear and it is fairly easy to work on. But I can't say that this is the situation with the rest of the amateur world. Surely, there are many who agree with me, but there are many more who would prefer to plunk down their plastic and buy ready-made gear.

And who's to say who's right? The only piece of advice I have for Heath is to consider realigning the pricing structure of their gear. If they can afford to cut margins and make their equipment the low-cost alternative again, they'll stand a chance of revitalizing a whole marketplace. Heath's equipment is good and something you can get your hands on. Now, isn't that something in this day of tiny rigs and tinier parts? You bet it is! Reader Service number 151.■

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WA2VUN rotates an unguyed, 86-foot, 2100-pound tower on a "lazy susan"—and lives to write about it!

This project started about two years ago while I was in the midst of erecting a Tri-Ex DX-86 tower in Spring Valley, New York. No doubt about it, the DX-86 is a lot of tower, standing 86 feet tall when fully raised and capable of supporting 25 square feet of wind loading. At 2100 pounds, it's probably the biggest crank-up available to amateurs.

I had previously owned a Tri-Ex LM-470, but was intrigued with the thought of 16 extra feet and additional capacity, since plans had been in the back of my head to put up arrays for 40 meters through 23 cm and build a super contest station. Unfortunately, the number of yagis I had in mind would exceed the wind load capacity of even the best rotors available.

Sure, a custom-built rotor would have fixed this problem, but as a welder I have certain skills and resources not available to most amateurs. Why not use a fixed mast to support the huge yagi arrays and rotate *the entire tower?* Why not, indeed! And so began one of the stranger but more rewarding projects I've ever been involved with.

The DX-86 was ordered from Tri-Ex and I set about creating the specifications. First, I'd need a strong mast—*very* strong. Not only that, since it couldn't rotate down or be dropped (being securely fastened in one position), some method of climbing the mast easily to do antenna work was needed.

The solution was to employ two separate pieces of pipe, the first a 21' x 2" piece of extra-heavy-wall seamless steel, the second a 28' x 1-1/2" piece which slid inside the first piece. Next, I cut sections of 5/8" Rebar and drilled the combination mast every 20", sliding the Rebar sections through to pin the two masts together and form a ladder to climb up. Neat!

Next, the top of the DX-86 was modified by replacing the mast guide with 2-1/2" pipe fitted with a steel plate so as to form a key at the lower end. This was bolted to the tower in place of the old mast guide. The combination mast section had a key slot machined into its lower end to fit into the steel plate, resulting in an extremely strong support. The 256-lb., 28-foot mast could now support two climbers to allow antenna work in any tower position, up or down. I could remove the mast if needed by lifting it out with a ginpole or small crane.

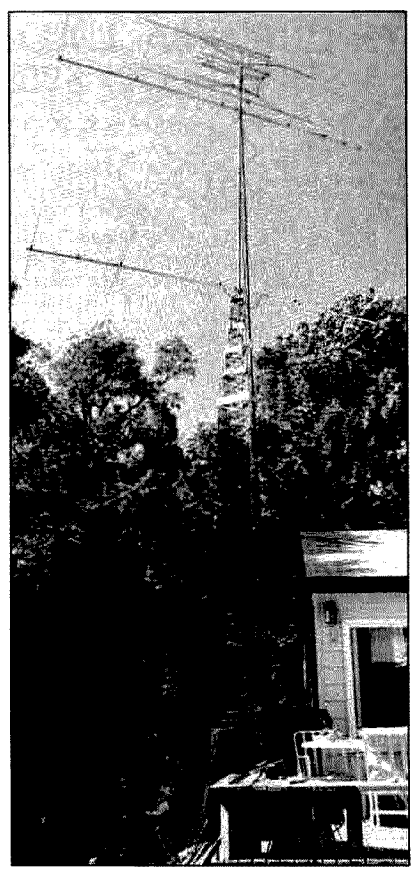


Photo A. The completed tower with about half of the antennas installed. Even in the cranked-down position it is over 60 feet tall. (Photo by KT2B.)

The DX-86 employs five sections, with extra-heavy cross bracing, thick walls on the extension sections, and roller guides to cut down on friction during crank-up or crank-down. However, I did replace the stock 1-HP, 220-volt crank motor with a remote-controlled 24-volt system so as to allow crank-up and crank-down operations from inside the house. This system was designed by Paul Olsen and features on/off lamp indicators for the "end of crank" limit points, as well as limit switches on the tower itself. These were very important, as I wouldn't be able to see the tower from my shack during operation.

While I was tackling the cranking problem, I decided to employ a custom-designed rotor-indicator system. (Remember now, I was rotating the entire DX-86 on a pedestal!) An old friend, Bob Nyire WA2AJV, came up with the solution, employing selsyn motors and indicators which were modified for the application by Phil Anderson W2HWG. These motors are connected to the rotor gear mechanism (I'll get to that in a moment) and allow a 400-degree rotation. Those of you who have operated contests or chase DX will remember the times you had your rotor on the east side of south and heard a rare one just the other side of south! This allows the extra rotation needed to make that contact. Limit switches kick in beyond this point.

On to the rotating pedestal. As with most big tower projects, you've got to start with a hole in the ground. The spot I chose for the DX-86 allowed no room for digging equipment, so I did it the good old-fashioned way—by hand. After getting about 2-1/2 feet deep rather quickly, I hit

hardpan, the next best thing to solid rock. Talk about tedious work! I measured progress in inches each day after work, but after many backrubs and jars of liniment, the hole was 6-1/2 feet deep by about 4-1/2 feet on a side, and it was time to pour the concrete base.

Allowing for a 6" form above the ground, it would take about 7 yards of concrete to do the job. Before this could be done, a steel anchorage for the pedestal base needed to be installed. This was made from 450 pounds of #7 and #8 Rebar welded into a cage form four feet on a side and six feet high. Additionally, I welded eight 8-inch pieces of 1-inch threaded rod to the top of the cage, which would protrude through the concrete and form the anchor points for the pedestal.

The pedestal carries the full weight of the DX-86 and supports the drive gear and turntable as well. For this application, I selected steel angle stock in 4'x 6'x 1/2" and 4'x 4'x 1/2" lengths. The shape is much like a pyramid with the top chopped off, tapering upward. The bottom is four feet square and sits nicely on the eight anchor bolts.

Total pedestal height is 6 feet. The retracted tower on the pedestal measures over 60 feet to the top of the mast! Fitted to the top of the pedestal is a 3-foot-diameter plate of 1-inch-thick steel. This plate has been machined with eight 3" slots that hold roller bearings, which in turn support a 1-3/8"-thick plate that forms the base of the tower.

"The rotor can rotate virtually any tower—even a good, straight utility pole if need be."

Here's where it gets tricky: Since this plate and the bearings form a "lazy-susan" arrangement, I had to grind, re-grind, and re-re-grind the plate to make sure it was absolutely flat. Nothing would look more unappealing than an 86-foot tower wobbling around in circles. Sure wouldn't help the neighbors' confidence level, either, especially those within 90 feet of the tower!

To complete the picture, I had to construct a means of turning the lazy-susan arrangement and provide additional support for this mass of metal balanced on a 3-foot plate. This was accomplished by selecting a piece of 6"-diameter, 1/2" wall steel tubing and welding a 6" heavy-duty pipe flange to one end. This was then turned in a lathe to make the flange absolutely square to the pipe. This shaft passes through both the upper rotating plate (which it's bolted to) and the lower bearing-support plate, via a 6"-diameter roller bearing.

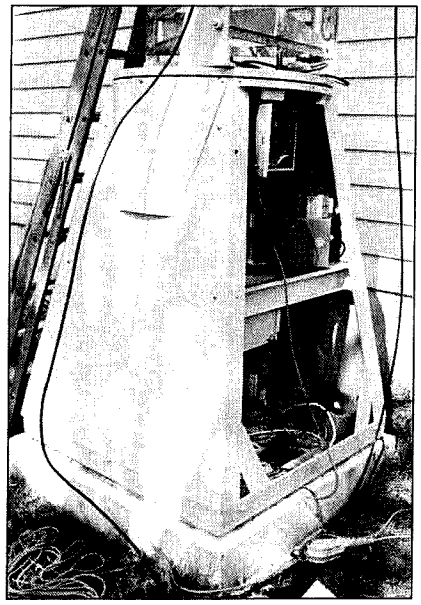


Photo B. The base pedestal with the cover removed. The large concrete base is visible, as is the lazy-susan turntable at the top. (Photo by KT2B.)

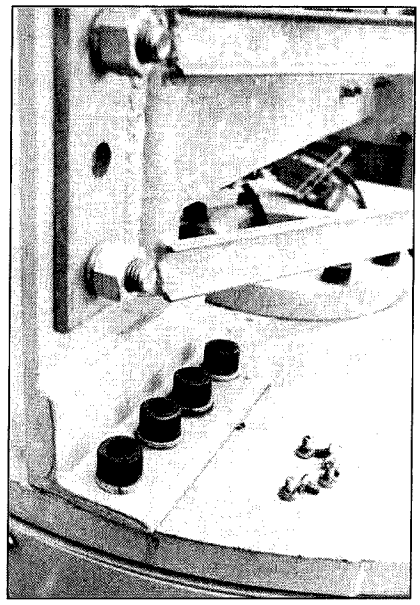


Photo C. Close-up of the method used to attach the tower to the rotating plate. (Photo by KT2B.)

The lower end of the shaft is also supported by a roller bearing to restrict side wobble and ensure proper centering. In addition, this end has a 22"-diameter, 1/2" #50 roller chain sprocket attached to it, forming the drive mechanism. A smaller roller chain sprocket on the shaft drives the selsyn position indicators and activates the limit switches when necessary.

To actually turn the beast, I selected a Dayton 1/2-HP, 120-V-ac motor rated at 1725 rpm output. Fastened to the drive gear is a double-reduction Ohio Gear Manufacturing right-angle worm drive, resulting in an 11-rpm shaft speed. Next, I fitted a 2-1/4", #50 roller chain sprocket to the output of the worm drive—and this is what drives the 22" sprocket on the rotor shaft. The final output torque from the motor/drive combination is about 20,000 lb!

The DX-86 will rotate a full 400 degrees in about 62 seconds, and do it with about as much noise as a small TV antenna rotator—it's that quiet. Best of all, there are no solenoid brakes to seize up or worry about (a common problem with Ham-4 or TailTwister rotors). The final touch was to paint the

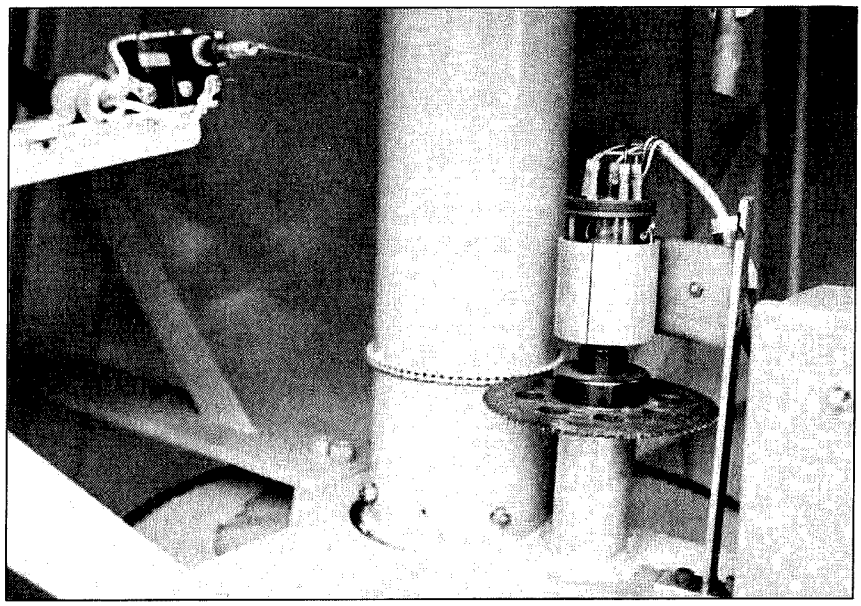
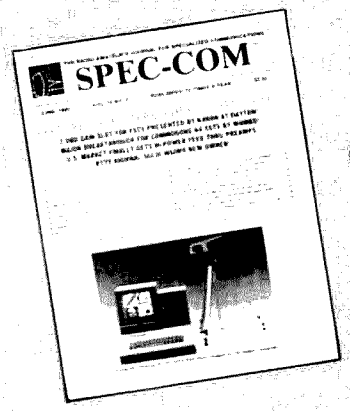


Photo D. The reduction gear mechanism for driving the selsyn direction indicator. A limit switch is visible at upper left. (Photo by KT2B.)

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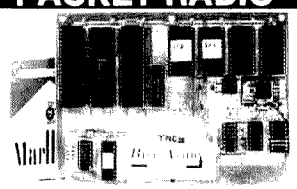
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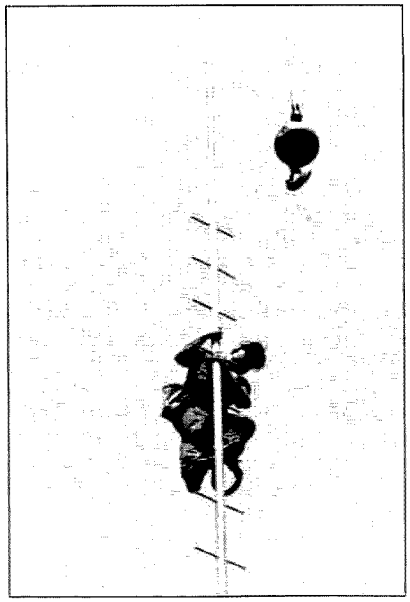


Photo E. The mast has just been installed with the help of a crane. WA2VUN is standing on Rebar steps. (Photo by WB2WIK.)

pedestal the same color as my house siding, so it blends in better.

Current plans are to install the following antennas (some, if not all, will be up by the time you read this):

4-element, 144-MHz yagi (FM)
7-element, 220-MHz yagi (FM)
Four 23-element, 1296-MHz arrays
Two 19-element, 432-MHz arrays
Two 17-element, 220-MHz boomers
Two 19-element, 144-MHz boomers
Two 7-element, long-boom 50-MHz yagis
Hy-Gain 205 BAS for 20 meters
Hy-Gain 105 BAS for 10 meters
Telrex TB-5 Tribander
KLM 3-element, 40-meter beam

The design, construction, and installation of this rotating tower took about one year (dovetailed into my work and play schedule) working days, weekends, and even nights where needed. As mentioned earlier, my main business is welding and fabrication. Note that all materials used are strictly "off the shelf" with the exception of the rotor, which can rotate virtually any tower—even a good, straight utility pole if need be.

If readers would like further details regarding construction and operation, I'd be glad to provide details upon request. (Please send an SASE.)

I'd like to thank the following people for making it all possible: my two kids, Jennifer and Matthew, for helping dig the hole; Bob Nyire WA2AJV for all his thoughts and input regarding the rotor and controls; Paul Olsen for the lift electronics design; Phil Anderson W2HWG for his help on the selsyn indicators; and finally, my wife, Jo-Ann, for putting up with all of the long hours I spent at my shop. ■

William R. Stocking W0VM
1030 Weidman Road
Manchester MO 63011

HF Antennas: All Bands, All Wire

Coax-hater W0VM resurrects the versatile tuned doublet for nine-band HF use.

With eight high-frequency amateur bands (1.8, 3.5, 7, 10, 14, 21, 24, and 28 MHz) and one more band to be added soon (18 MHz), it is not practical to have a separate coax-fed dipole for each band. It would also be difficult to design a trapped antenna that would work on all of these bands. However, by using the kinds of antennas that were common in early days of amateur radio, *one* antenna can be made to provide good results on all of these bands.

If an historian were to write a history of amateur radio antenna design, he would divide this history into two periods. The first period would be the B.C. (before coax) period in which the objective of antenna design was to obtain the best possible performance. The second period would be called the A.C. (after coax) period. The convenience of coax, combined with human laziness, changed the course of amateur antenna design—antennas had to perform with coax feedlines. It has now become apparent that much performance was sacrificed in order to have coax feedlines. This was especially true with respect to multiband antennas. Now, many hams are using B.C.-type antennas.

Such an antenna can be built for very little money. Furthermore, on the higher bands, these antenna systems have *gain* as compared to a half-wavelength dipole. When erected in the form of an inverted vee, these antennas send and receive well in all directions.

The purpose of this article is to describe three nine-band antenna systems, to give approximate values of their gain for each band (as compared to a half-wave dipole for that band), and to present the directional patterns for each band.

All three of these antenna systems are fed with balanced tuned feeders and require a little work in adjusting an antenna tuner (or "transmatch") that has a balanced rf output. This little bit of work provides greatly improved performance as compared to a coax-fed antenna.

Antenna Number One

The first antenna to be discussed is a half-wavelength centerfed zepp for 3.5 MHz (the correct name for this type of antenna is a "tuned doublet," but it is commonly called a centerfed zepp). Each side of the center insulator should be approximately 66 feet long. (The exact length is not important so long as the wires on each side of the center are the same length; 60 feet could be used if that would be more convenient.) The tuned feedline can be made of either open-wire (ladder) line or of good quality twinlead (preferably of the heavy-duty transmitting type). It is often convenient to use open-wire line from the center of the antenna to the grounding switch outside of the shack and to use twinlead from

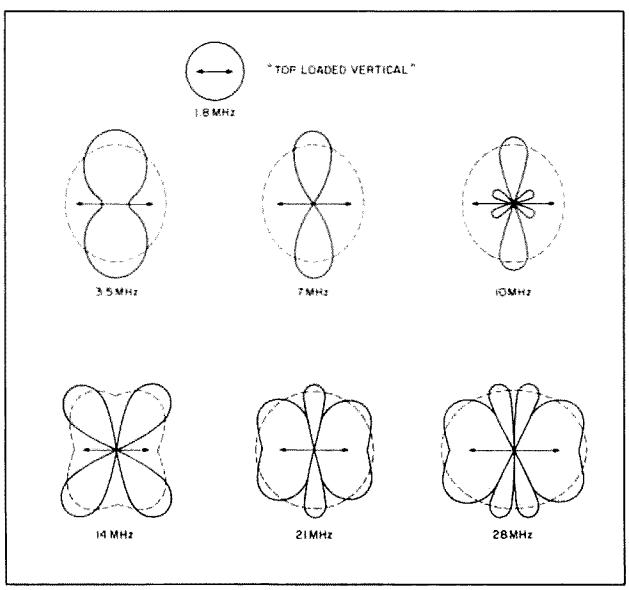


Fig. 1. Approximate directional patterns for antenna number one (66 feet each side of the center). The dotted lines show the patterns when the antenna is in the form of an inverted vee.

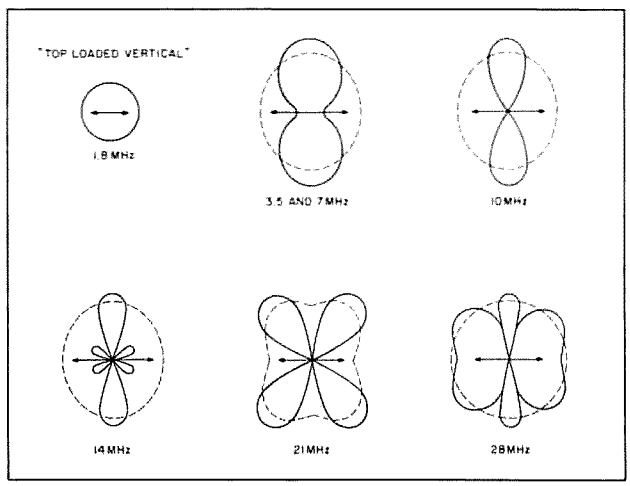


Fig. 2. Approximate directional patterns for antenna number two (51 feet each side of the center). The dotted lines show the patterns when the antenna is in the form of an inverted vee.

the grounding switch to the antenna tuner inside the shack.

Some amateur operators think that tuned feeders (or resonant lines) must be in the form of open-wire or ladder lines. This is not true. Excellent results can be obtained using good quality twinlead. The feedline to my big tuned doublet contains about 50 feet of homemade open-wire line and about 50 feet of three different kinds of twinlead, all in series.

The directional patterns and gains of this antenna (as compared to a dipole for each band) are shown in Fig. 1, and how to use the antenna system on the 1.8-MHz band will be explained later in the article.

On the 3.5-MHz band, the antenna system functions as a half-wavelength dipole. However, it will work much better than a coax-fed dipole because the antenna system can be tuned to resonance at the exact frequency being used, whether the frequency is near the low end of the CW band (3.500 MHz) or near the high end of the phone band (4.000 MHz). The antenna will send and receive best at right angles to the antenna wires. However, if the antenna is in the form of an inverted vee, it will send and receive reasonably well in all directions. For best east and west coverage, the antenna wires should run north and south.

Antenna engineers do not consider the inverted-vee configuration to be a good antenna design. Having the ends of the antenna nearer the ground than the center introduces losses not present when the antenna is horizontal. If the antenna is an inverted vee, it is a good idea to have the angle between the wires at the center of the antenna at least 120 degrees. In spite of the views of antenna engineers, many amateurs use inverted-vee antennas with good results.

On the 7-MHz band, the antenna will function as two half-wave antennas fed in phase. *It does not* function as a full-wave antenna, as was erroneously stated in a past *73* article ("So Why Do They Call It Wireless?" March, 1985). The gain as compared to a 7-MHz dipole will be 1.8 dB plus whatever gain can be attributed to the use of tuned feeders instead of coax feed. The strongest signals will be at right angles to the antenna, but an inverted-vee configuration will provide good coverage in all directions.

On the 10-MHz band, this tuned doublet will be even more effective. It will function as a long "extended double zepp" with a gain of nearly 3 dB as compared to a half-wavelength dipole, and with the greatest signal strength at right angles to the antenna wires.

On the 14-MHz band, the 3.5-MHz tuned doublet functions as two one-wavelength antennas fed with rf currents in phase. This provides a four-leafed-clover radiation pattern with lobes 52 degrees from the line of the wires. (As usual, the inverted-vee configuration will provide coverage in all directions.) The gain in the directions of the lobes should be at least 1 dB.

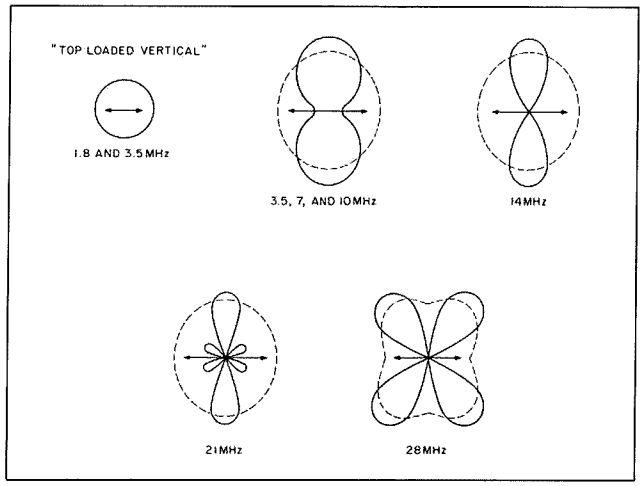


Fig. 3. Approximate directional patterns for antenna number three (33 feet each side of the center). The dotted lines show the patterns when the antenna is in the form of an inverted vee.

On the 18-, 21-, 24-, and 28-MHz bands, there will be four main lobes and two or more minor lobes. As the frequency gets higher, the angles that the four main lobes make with the direction of the wires become smaller and smaller, and minor lobes (at nearly right angles to the wires) appear. On the 21-MHz band, the antenna functions as two 3/2-wavelength antennas with rf currents in phase, and the gain in each major lobe should be at least 1.5 dB.

On the 28-MHz band, the antenna functions as two two-wavelength antennas with currents in phase, with gains in the major lobes of at least 3 dB. (In spite of extensive reading of antenna articles, I have been unable to find gain figures for the 14-, 21-, and 28-MHz bands using the 3.5-MHz tuned-doublet antenna, so the gain figures presented are guesstimates. The actual gains probably would not be less than these figures and might be more. One antenna authority wrote that the gain on the 28-MHz band should be 4 dB in the main lobes.)

Antenna Number Two

A tuned-doublet antenna system does not necessarily have to have its wires any particular length so long as each wire is exactly the same length as the other one. Moreover, a length can be chosen that will favor certain bands. A good length to have each side of the center is 51 feet. This is the length made popular by G5RV. An antenna with 51 feet each side of the center is slightly less effective on the 3.5-, 7-, and 10-MHz bands than the antenna with 66 feet each side of the center, but it is more effective on the 14-MHz band because it is a long (3/4-wavelength) extended-double-zepp antenna with a gain of nearly 3 dB on that band. The antenna sends and receives best at right angles to the antenna wires on the 3.5-, 7-, 10-, and 14-MHz bands. The four-leafed-clover radiation pattern does not develop until it is used on the 21-MHz band.

The gain figures for this antenna on the 3.5-, 7-, 10-, and 14-MHz bands are as follows: 3.5 MHz—none, 7 MHz—1.5 dB (guesstimate), 10 MHz—at least 1.8 dB, and 14 MHz—nearly 3 dB.

On the 21-MHz band, the main lobes would be in a four-leafed-clover pattern with the angles of the lobes 52 degrees from the line of the wires, and the gain in the main lobes estimated to be at least 1.5 dB. There would be a similar pattern on the 28-MHz

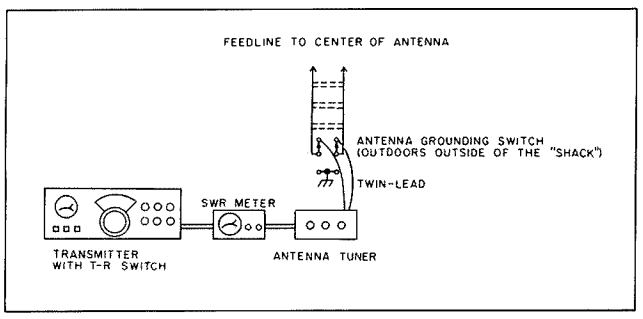


Fig. 4. The antenna system's connections to the transmitter.

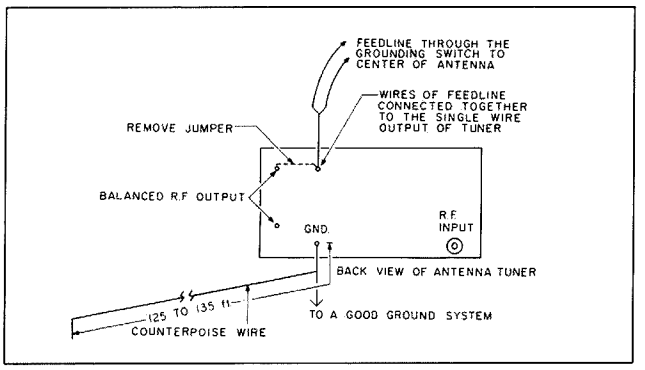


Fig. 5. Connections for using the antennas as top-loaded vertical antennas.

band with the angles of the lobes to the wires being a bit smaller than that of the 21-MHz lobes.

Both of the above-described antennas can be used on the 1.8-MHz band by connecting the ends of the feedline together on the single-wire output of the antenna tuner. There should be a good ground connected to the tuner. A "counterpoise wire," 125 to 135 feet long, connected to the ground post of the tuner, helps. (This wire can be strung along a fence in the yard or otherwise supported above the ground. The counterpoise wire does not have to be stretched out straight but can be located wherever there is space and can have many bends in it.) When used in this way on the 1.8-MHz band, these two antennas will be functioning as "top-loaded vertical antennas" with the feedline part of the system doing the radiating. The antenna wires provide the "top loading." This top-loaded vertical will send well in all directions with perhaps a bit more in the directions of the wires.

Antenna Number Three

Where space is limited, an antenna with shorter wires can be used. This third tuned-doublet antenna has wires 33 feet long on each side of the center. Although it will load up and make contacts on the 3.5-MHz band, it probably would work better as a top-loaded vertical antenna on that band. (This was the experience of N0EVQ.)

On the 7-MHz band, this antenna system functions as a half-wavelength dipole with best directions at right angles to the antenna wires. (An inverted-vee configuration provides coverage in all directions, as is the case with the other two antennas.)

On the 10-MHz band, the antenna could be considered an elongated half-wave dipole or a much shortened "two half waves in phase" with best directivity at right angles to the antenna wires and with some gain as compared to a half-wave dipole.

On the 14-MHz band, the antenna would be "two half waves in phase" with a gain of 1.8 dB as compared to a dipole and best directivity at right angles to the antenna wires.

On the 21-MHz band, the antenna would be two 3/4-wavelength wires fed in phase. This would be an elongated extended double zepp with best directivity at right angles to the wires and with a gain of at least 2 dB as compared to a dipole.

On the 28-MHz band, the antenna would function as two full-wavelength antennas fed with currents in phase and with a four-leafed-clover directivity pattern with lobe angles of 52 degrees from the line of the wires. A gain of at least 1 dB in each lobe could be expected.

This antenna could be used as a top-loaded vertical on the 1.8-MHz band, connected as described earlier in this article.

Although this article has shown how to use these antenna systems on only the eight HF bands that we now have, they will certainly work well on the 18-MHz band after we get it.

When these antennas are used as top-loaded vertical antennas, the gain (or loss) and directivity patterns will vary with each installation. On the 1.8-MHz and 3.5-MHz bands, there will actually be loss as compared to a half-wave dipole for the band. (The antennas will work as top-loaded verticals on other bands, and trying this on the other bands could provide some interesting results.) The effectiveness of these antennas when used as top-loaded verticals will depend on the antenna's height above ground and on how nearly vertical the feedline (now the radiator) is. The higher the antenna is the better, and the more nearly vertical the feedline is the better. Vertical antennas send in all directions. It should be noted that the 1.8-MHz band is a vertical-antenna band because it is extremely difficult to put up a horizontal antenna high enough to be effective on this band (250 feet). As one writer put it, "On the 160-meter band, a horizontal antenna compares favorably with a dummy load."

Choosing Antenna Size

The choice of which nine-band antenna system an operator should build will depend on the space available, which bands are his favorites, and what other antennas, if any, he may have. For example: If space is available and the operator already has a triband beam antenna for the 14-, 21-, and 28-MHz bands, a tuned-doublet antenna system 66 feet each side of the center is the logical choice. It provides 1.8-MHz operation when used as a top-loaded vertical. The 3.5-MHz performance is much better than a coax-fed dipole on that band. The antenna provides a gain of 1.8 dB on the 7-MHz band and a gain of nearly 3 dB on the 10-MHz band. The triband beam can take care of the 14-, 21-, and 28-MHz bands.

If the operator's favorite band is the 14-MHz band and he does not have a beam antenna, the antenna with 51 feet each side of the center is the logical choice. The gain on the 14-MHz band would be nearly 3 dB because the antenna is a long, extended double zepp on that band.

The smallest of the three antennas would be used where there is not enough space for either of the larger antennas. There is nothing sacred about the lengths of 66 feet, 51 feet, and 33 feet each side of the center. Lengths between these can be used as long as the lengths each side of the center are the same. Longer wires favor the lower frequencies. I had an antenna with 40 feet each side of the center that worked very well on the 7-, 14-, and 21-MHz bands. For anyone who wishes to maximize the performance on any particular band, the extended-double-zepp lengths each side of the center are as follows: 7 MHz = 84 feet; 10 MHz = 60 feet; 14 MHz = 44 feet; 21 MHz = 28 feet; 28 MHz = 25 feet.

Using the Tuned-Doublet Antenna System

The antenna system is connected to the transmitter as shown in Fig. 4. The transmitter's output is connected through the T-R switch (built into transceivers and most transmitters) by a short piece of coax to the input of the swr meter. The output of the swr meter is connected to the input of the antenna tuner (or transmatch) by another short piece of coax. The feedline from the antenna is connected to the balanced output of the antenna tuner.

Using low-power output from the transmitter, the antenna tuner is adjusted until the swr meter shows little or no reflected power. The transmitter is next loaded up to the desired power, and the antenna tuner's dials are "touched up" to provide minimum reflected power showing on the swr meter. With a good antenna tuner, it is usually possible to tune up so that there is practically no reflected power. After this has been done, the frequency and tuner settings should be recorded for future use. Finding the correct tuner settings for several frequencies in each amateur band takes time. However, once these frequencies and tuner settings have been recorded, the operator can quickly tune his antenna system to resonance at the desired frequencies by looking at the recorded dial settings.

Conclusions

It would be difficult, if not impossible, to design and build a coax-fed trapped antenna that would work on all nine bands. If such an antenna could be designed, it would have *loss* on each band compared to a half-wave dipole for the band being used. Besides not being very good, the cost of such an antenna would be outrageous. (A trapped antenna for *only three bands* costs in the neighborhood of $130.) Any of the three nine-band antenna systems in this article could be built for less than $50. The performance on each band would be much better than could be obtained from a nine-band coax-fed antenna, even if such could be designed and were available.

If you prefer the *best possible performance*—and don't mind a little extra—then the antenna systems described in this article are for you.

Build one of these antennas, use tuned feeders, and experience the excellent results you can obtain on all bands by using *one* well-designed antenna system. ■

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Watts My Line

Transmission-line tutorial— K4IPV explains four common types.

The transmission line is the wire that connects the output of your transmitter to the antenna or other load. For most of us, the transmission line will be a piece of coaxial cable with a surge impedance of either 52 or 75 Ohms. Fortunately, the antenna manufacturers and transceiver manufacturers conspire with each other to standardize designs. All we normally have to do is connect the standard output of our transmitter to a standard 52- or 75-Ohm coaxial cable and the cable to the standard input at the antenna feedpoint.

Not all of us are able to use standard values, however, and for this type of situation we need to know a little bit about transmission lines. Not much, mind you, but a little. There are, for example, times when we will have to make our own transmission line. That's right, I said *make*! This point was driven home to me recently by a DX contact who is engaged in missionary broadcasting in the wilderness some place or another in Africa. He pointed out that low-budget radio stations often have to make do with local materials, and for him that meant making his own special impedance transmission line for use in a quarter-wave matching section.

You remember the old formula: $Z_o = \sqrt{Z_L Z_S}$? Unfortunately, the value of transmission-line impedance calculated for his situation did not compare favorably with one of the standard values—which weren't available anyway. He had to use the formula for parallel-feeder surge impedance to find appropriate spacing for the diameter conductors that he did have available. It worked!

In this article, I'll look at some of the most common forms of transmission line and show you how to calculate the surge impedance. There also is a program in Basic that will aid in the calculation for four types of transmission line: coaxial cable, parallel feeders, shielded parallel feeders, and VHF/UHF/microwave "microstrip" lines.

Characteristic, or "Surge," Impedance

We frequently bandy about the "impedance" of transmission lines. We refer to 52-Ohm or 75-Ohm coaxial cable, for example. Just what is this impedance? Note that two terms are used for transmission-line impedance: characteristic impedance and surge impedance. As far as I can tell from my literature search, they are the same and so will be used as such here.

The surge impedance of a transmission line is derived from the distributed inductance and capacitance of the line. All forms of transmission lines exhibit these parameters. The capacitance comes from the fact that the two conductors are in close proximity, while the inductance comes from the length of the conductors (no doubt there is also some mutual inductance).

The impedance is $Z_o = \sqrt{L/C}$, where L is the inductance per unit of length in henrys (e.g., H/ft.), and C is the capacitance per unit of length in Farads (e.g., F/ft.).

Note that the impedance is not dependent on length because length appears in both numerator and denominator of the above equation. I have heard supposedly knowledgeable people tell Novices and engineering students that characteristic impedance is measured in "Ohms per foot," and since impedance is resistive in nature it can be measured on an ohmmeter! Horse feathers!

The surge impedance could also be defined in a naive manner by stating that it is the value of terminating resistance (i.e., load impedance) that will not reflect any power back down the line. Thus, when a 75-Ohm transmission line is connected to a 75-Ohm resistive load, none of the forward power is reflected back down the line toward the transmitter.

Coaxial Cable

Perhaps the most widely used transmission line is coaxial cable (see Fig. 1). The name of this transmission line is derived from the fact that the two conductors have the same axis and thus are *co*axial (Fig. 1(a)). The coaxial cable consists of an inner conductor surrounded coaxially by an inner insulator and an outer conductor. An optional outer insulator is also provided on most types (Fig. 1(b)).

The outer conductor is usually braided copper, sometimes tinned and sometimes not. In some special types of coax, however, the outer conductor (or shield) may be aluminum foil (color-TV transmission line), helical armor (like BX electrical cable), or solid pipe (used in some broadcast applications). In the last case, the coax might be fitted with gastight flanges and ceramic spacers (internal). That type of coax is used in high-power,

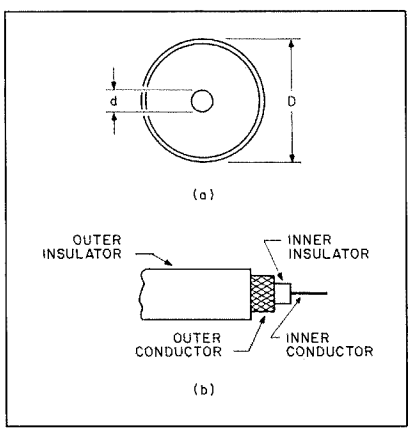


Fig. 1. Coaxial cable.

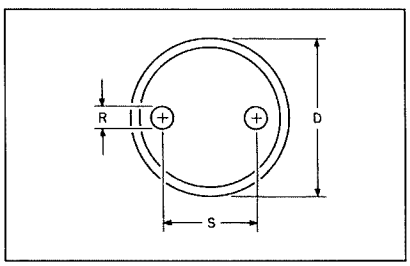


Fig. 2. Shielded parallel line.

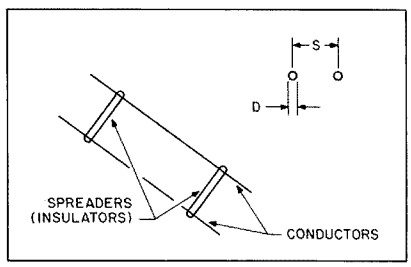


Fig. 3. A parallel feeder.

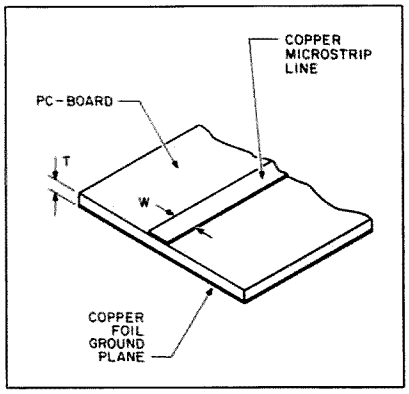


Fig. 4. A common microstrip configuration.

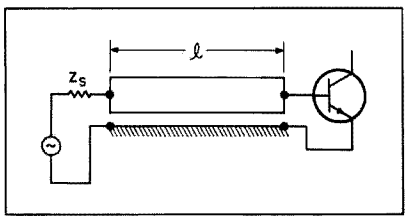


Fig. 5. Schematic representation of a microstrip transmission line.

low-frequency applications, and its dielectric is dried nitrogen gas.

The inner insulator for most types of coax is not quite so exotic, however. Materials such as polyethylene, poly foam, and Teflon™ are used.

One factor affected by the type of inner conductor is the velocity factor (V). This factor is the percentage of the speed of light, expressed as a decimal fraction, that the radio wave travels inside of the coax. Thus, when we say that a foam dielectric coax has a velocity factor of 0.8, we are saying that the radio signal inside the cable propagates at a velocity of 0.8 times the speed of light (0.8C). The velocity factors for common types of coax are 0.66 for polyethylene, 0.80 for poly foam, and 0.70 for Teflon.

The characteristic impedance of coaxial cable is given by $Z_o = (138/\sqrt{E} \times \text{Log}(D/d)$, where $E = 1$ for air, and $1/V^2$ for other dielectrics.

Shielded Parallel Feeders

Shielded parallel feeders are not used extensively by amateurs but are found in television applications. One suspects that users of folded dipoles and certain other types of antennas that are amicable to this form of transmission line might want to consider it because of TVI.

An example of shielded parallel line is shown in Fig. 2. Note that the transmission line consists of two conductors parallel to each other and surrounded by a shielded braid not unlike coaxial cable. The surge impedance of this transmission line is given by $Z_o = (276/\sqrt{E}) \times \text{Log}\{[(1 - B^2)/(1 + B^2)] \times 2A\}$, where $A = S/D$ and $B = S/R$.

Commercial types of shielded parallel lead are available in 300-Ohm surge impedance

Program listing.

```
100  REM  The name of this program is TRANLINE
110  REM  This program calculates the characteristic impedance of four
120  REM  different types of radio transmission line.  See also programs
130  REM  QUARSEC and MATCHING.SEC
140 S = 22
150 Q = 18
160  GOSUB 1970
170 PRINT TAB(S);"* * * * * * * * * * * * * * * * * * * * * * *"
180 PRINT TAB(S);"*                                           *"
190 PRINT TAB(S);"*  PROGRAM TO CALCULATE CHARACTERISTIC      *"
200 PRINT TAB(S);"*      IMPEDANCE OF TRANSMISSION LINES      *"
210 PRINT TAB(S);"*                                           *"
220 PRINT TAB(S);"*       Copyright 1983 by J.J. Carr         *"
230 PRINT TAB(S);"*                                           *"
240 PRINT TAB(S);"* * * * * * * * * * * * * * * * * * * * * * *"
250 GOSUB 1930
260 GOSUB 2010
270 GOSUB 1970
280 PRINT TAB(Q);"This program will compute the characteristic impedance"
290 PRINT TAB(Q);"cable, parallel (open-wire), parallel-shielded and "
300 PRINT TAB(Q);"parallel (printed circuit) strip-line."
310 GOSUB 1930
320 GOSUB 2010
330 GOSUB 1930
340 PRINT TAB(Q);"SELECT One (1) From Menu Below:"
350 PRINT
360 PRINT TAB(Q);"1.  Two-conductor COAXIAL cable"
370 PRINT TAB(Q);"2.  Parallel Feeders (open-wire)"
380 PRINT TAB(Q);"3.  Shielded Parallel Conductor"
390 PRINT TAB(Q);"4.  Microstrip (PC) Parallel Line"
400 PRINT
410 INPUT "SELECTION?",M
420 ON M GOTO 430, 850, 1140, 1470
430 GOSUB 1930
440 PRINT "COAXIAL CABLE SELECTED"
450 PRINT
460 PRINT "Diameters d and D are to be in SAME UNITS"
470 PRINT
480 INPUT "Diameter of inner conductor (d):";D1
490 PRINT
500 INPUT "Overall outside diameter (D):";D2
510 GOSUB 1930
520 PRINT "Select dielectric material:"
530 PRINT
540 PRINT "1.  Foamed Polyethylene"
550 PRINT "2.  Regular Polyethylene"
560 PRINT "3.  Teflon"
570 PRINT "4.  Air-Space Polyethylene"
580 PRINT "5.  Air Insulated"
590 PRINT
600 INPUT "Selection?",S
610 IF S = 1, THEN V = .8
620 IF S = 2, THEN V = .66
630 IF S = 3, THEN V = .7
640 IF S = 4, THEN V = .86
650 IF S = 5, THEN V = 1
660 IF S > 5, THEN GOTO 530
670 E = 1/(V^2)
680 ZA = LOG(D2/D1)
690 ZA = ZA*.4343
700 ZB = 138/(SQR(E))
710 ZO = ZA*ZB
720 ZO = FIX(ZO)
730 PRINT "ZO =";ZO
740 PRINT "E=";E
750 PRINT "V=";V
760 GOSUB 2010
770 PRINT
780 PRINT "1.  Do another COAXIAL CABLE?"
790 PRINT "2.  Select Another Type of Transmission Line?"
800 PRINT "3.  Finished?
810 PRINT
820 INPUT "Selection?",P
830 IF P > 3, THEN GOTO 770
840 ON P GOTO 430,330, 2040
850 GOSUB 1930
860 PRINT "PARALLEL OPEN-WIRE FEEDERS SELECTED"
870 GOSUB 1930
880 PRINT "All dimensions in SAME UNITS!"
890 GOSUB 1930
900 GOSUB 2010
910 GOSUB 1930
920 INPUT "ENTER conductor diameter:",D
930 PRINT
940 INPUT "ENTER conductor spacing:",S
950 PRINT
960 ZA = (2*S)/D
970 ZA = LOG(ZA)
980 ZA = .4343*ZA
990 ZO = 276*ZA
1000 PRINT
1010 PRINT "ZO =";ZO
1020 PRINT
1030 PRINT "Velocity factor (V) and Dielectric Constant (E)"
1040 PRINT "defined as 1"
1050 GOSUB 1930
```

```
1060 GOSUB 2010
1070 GOSUB 1930
1080 PRINT "1.  Do Another PARALLEL OPEN-WIRE LINE?"
1090 PRINT "2.  Select Another Type of Transmission Line?"
1100 PRINT "3.  Finished?"
1110 PRINT
1120 INPUT "SELECTION?",P
1130 ON P GOTO 850,330,2040
1140 GOSUB 1930
1150 PRINT "SHIELDED PARALLEL CONDUCTOR SELECTED"
1160 PRINT
1170 PRINT "All Dimensions are to be in SAME UNITS!"
1180 PRINT
1190 INPUT "ENTER CONDUCTOR-to-CONDUCTOR SPACING:",H
1200 PRINT
1210 INPUT "ENTER INNER CONDUCTOR DIAMETER:",D1
1220 PRINT
1230 INPUT "ENTER OUTER-SHIELD DIAMETER:", D2
1240 PRINT
1250 B = H/D2
1260 A = H/D1
1270 C = 2*A*((1-B^2)/(1+B^2))
1280 F = LOG(C)
1290 F = .4343*F
1300 V = .8
1310 E = 1/SQR(V)
1320 ZO = (276*F)/SQR(E)
1330 PRINT
1340 PRINT "ZO =";ZO
1350 PRINT "V =";V
1360 PRINT "E =";E
1370 PRINT
1380 GOSUB 2010
1390 GOSUB 1930
1400 PRINT "1.  Do Another Shield Parallel Conductor Line?"
1410 PRINT "2.  Select Another Type of Transmission Line"
1420 PRINT "3.  Finished?"
1430 PRINT
1440 INPUT "SELECTION?",M
1450 IF M > 3, THEN GOTO 1390
1460 ON M GOTO 1140,330, 2040
1470 GOSUB 1930
1480 PRINT "MICROSTRIP (Printed Circuit) LINE SELECTED"
1490 GOSUB  1930
1500 PRINT "All Dimensions Must be in SAME UNITS!"
1510 GOSUB 1930
1520 GOSUB 2010
1530 GOSUB 1930
1540 INPUT "ENTER printed circuit board thickness:",T
1550 GOSUB 1930
1560 INPUT "ENTER conductor width:",W
1570 GOSUB 1930
1580 PRINT "Select BOARD TYPE:"
1590 PRINT
1600 PRINT "1.  Glass-Epoxy"
1610 PRINT "2.  Teflon-loaded Glass"
1620 PRINT
1630 PRINT
1640 INPUT "SELECTION?",G
1650 IF G > 2, THEN GOTO 1570
1660 IF G = 1, THEN E = 4.8 ELSE E = 2.5
1670 ZA = W*(SQR(E))
1680 ZB = T/ZA
1690 ZO = 377*ZB
1700 K = (W/T)^-.836
1710 L = 1.735*(E^-.724)
1720 J = K*L
1730 Y = 1+J
1740 ZO = ZO/Y
1750 ZO = FIX(ZO)
1760 GOSUB 1930
1770 PRINT "ZO =";ZO
1780 PRINT "Width (W):";W
1790 PRINT "Board Thickness (T):";T
1800 IF G = 2, THEN GOTO 1830
1810 PRINT "E =";E:" for Glass-Epoxy Boards
1820 GOTO 1840
1830 PRINT "E =";E;" for Teflon-loaded Glass boards"
1840 GOSUB 2010
1850 GOSUB 1930
1860 PRINT "1.  Do Another Microstrip Line?"
1870 PRINT "2.  Select Another Type of Line?"
1880 PRINT "3.  Finished?"
1890 PRINT
1900 INPUT "SELECTION?",P
1910 IF P > 3, THEN GOTO 1850
1920 ON P GOTO 1470,330, 2040
1930 FOR I = 1 TO 5
1940 PRINT
1950 NEXT I
1960 RETURN
1970 FOR I = 1 TO 30
1980 PRINT
1990 NEXT I
2000 RETURN
2010 PRINT "Press ANY key to continue:"
2020 A$=INKEY$: IF A$="" THEN 2020
2030 RETURN
2040 PRINT "end"
```

capable of delivering several hundred Watts to the antenna. I have found that this kind of line gets too warm when a kilowatt is used. While that experience is almost two decades old by now, I have little reason to believe that a strictly television-reception type of line will perform effectively on a high-power transmitter antenna. With a standard 100-200-Watt transceiver, however, there will be little problem provided that impedance matching at the feed end of the line is done correctly.

Parallel Feeders

This is the type of transmission line spoken of by my DX contact in Africa (see Fig. 3). This was the first type of line used by amateurs that wasn't a simple length of wire indistinguishable from the antenna itself! The line consists of two parallel inductors separated by an insulator—usually air, in amateur transmission lines. (TV twinlead is the same sort but uses vinyl insulation.)

Amateurs typically use solid or stranded wire for the conductors, except when making certain matching sections and ceramic spreaders for insulators. I have seen spreaders sold with several notches for the conductors along the length so that distance between the conductors can be varied to obtain a specific impedance value. There are two versions of the formula, but the simplified case, that assumes an air dielectric, is Z_o = 276Log(S/D).

Parallel feeders can be built for almost any practical impedance that you might need. In most cases, we will know the impedance and can select standard diameters for the conductors from available stock. In that case, we will want to solve the above equation for the spacing, S, which is exactly what most texts delete: $S = D10^{Z_o/276}$, where D is the conductor diameter, Z_o is the desired impedance, and S is the spacing. (S and D must be specified in the same units, e.g., feet, meters, inches.)

Microstrip Line

Microstrip line is a form of transmission line used at VHF, UHF, and microwave. It is formed on printed circuit boards (see Fig. 4). This transmission line is formed from an etched conductor on the board surface counterpoised against a copper-foil ground plane on the other side of the board. Obviously, double-sided board is needed. The characteristic impedance is given by $Z_o = (377/\sqrt{E_t}) \times (T/W)$, where Z_o is the characteristic impedance, W is the conductor width, T is the board thickness, and E_t is the dielectric constant of the board material. Fig. 5 shows a typical use of a microstrip line in a UHF or microwave amplifier.

Computer Program

A computer program for the impedance equations used in this article is shown in the listing. This program is in the MS-DOS Basic used in the IBM PC and should be compatible with other Microsoft Basics. In any event, the program is easily translatable for other Basics—something I had in mind since I have both Apple and IBM PC computers. ■

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Scaling the Wet Noodle

It's ham radio's equivalent of a ship in a bottle: Evaluate your antenna's design with a quarter-scale model.

Have you ever had an idea for a new antenna system and would like to know how well it might perform without doing too much work? Then consider reducing the antenna's size, so you can modify and test it without wearing yourself out raising and lowering the brute. Fortunately, the amateur frequency assignments are almost ideal for scale models. Scale modeling is accomplished by reducing the size of the antenna by some scale factor, then increasing the test frequency by this same factor. For example, a one-quarter-scale model of a 160-meter antenna can be tested on the 40-meter band (4 x 1.8 MHz = 7.2 MHz). With a little more ciphering, you can determine all other possible combinations.

Wanting to get on 160 meters, but not having the real estate necessary to erect an inverted vee or a dipole, I was stuck with putting up some kind of vertical that would be reasonably efficient and small in size (these aren't very compatible). Since I have had some experience in designing top-loaded vertical antennas, I came up with the idea of utilizing both capacitive and inductive top loading (not original by any means).

After scouting around a little, I located a source of 20-foot sections of fiberglass pipe varying in diameter from 1.5 inches to 3 inches; they could be telescoped. This looked like an ideal mast for what I had in mind.

For the capacitance hat, I thought I might use several spokes made from small-diameter aluminum tubing, mounted on a disk/hub assembly that could be bolted to the top of the fiberglass mast. The loading coil could then be wound on the mast slightly below this capacitance hat.

Now came the design problem: How much inductance would be required to resonate this structure in the middle of the 160-meter band? I could see myself raising and lowering the antenna several times, using the old "try and try again" technique. Here my 70-year-old friend Willie W5FXP came to the rescue by suggesting I build and test a quarter-scale model. Willie, as usual, was quite persistent. So, since he was willing to help, why not?

For the full-scale model inductor and antenna wire, I had located an inexpensive source of industrial-grade insulated solid-copper wire (#12 THHN). This wire with insulation was approximately 1/8 inch in diameter. Dividing this by 4 produced a scale-model wire diameter of 0.03125 inches,

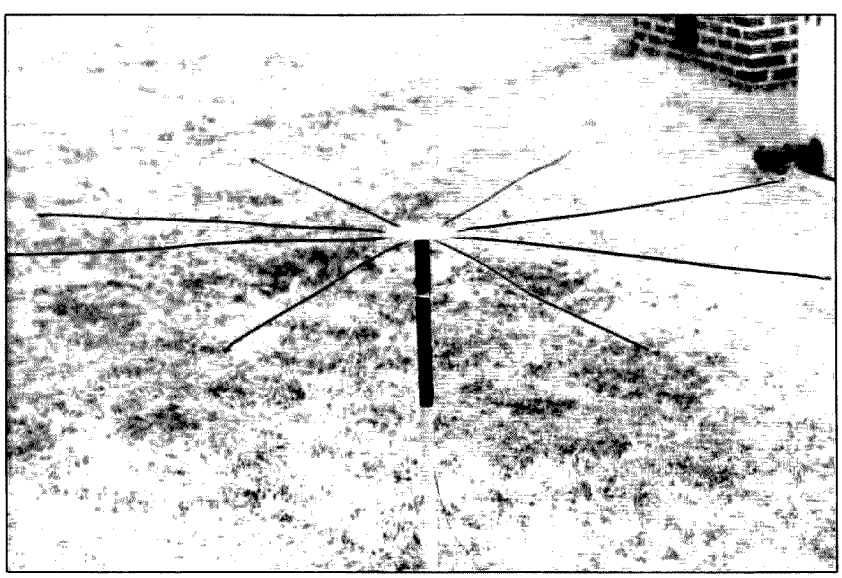


Photo A. Bird's-eye view of the quarter-scale top hat and loading coil.

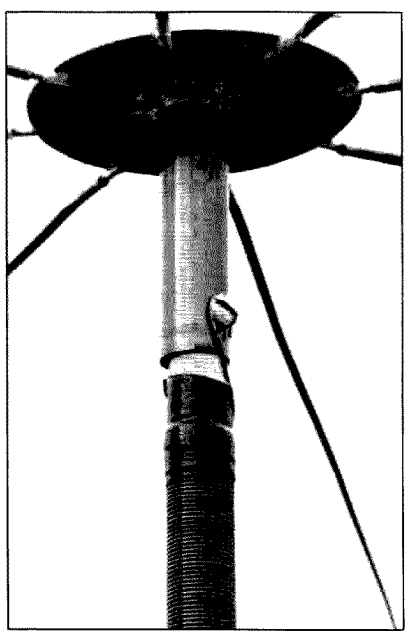


Photo B. Construction details of the quarter-scale top hat.



Photo C. Quarter-scale antenna held by full-scale W5RRH. The full-scale antenna mast can be seen in the background.

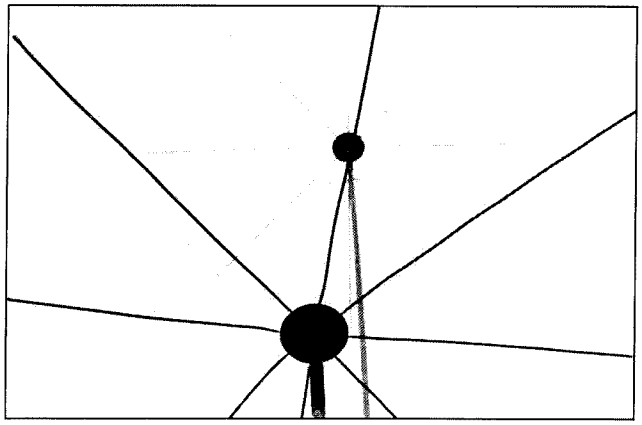


Photo D. Quarter-scale and full-scale top hats and loading coils.

about the same as #20 wire. We figured this should be suitable for the quarter-scale model inductor and antenna wire.

I had decided on using the 1.5-inch fiberglass pipe for the full-scale mast, sliding this into a short piece of 2-inch fiberglass pipe which would be set in concrete. This would give me an overall mast height of approximately 25 feet. Scaling this down by a quarter dictated a coil form 1/2 inch in diameter, and a mast 6 feet 3 inches high.

Next came the capacitance hat. For the full-scale model, I had acquired four 12-foot sections of 1/2-inch aluminum tubing. Cutting these in half would provide eight "spokes," each 6 feet in length. For mounting, a 6-inch-long 2.062-inch-i.d. aluminum tube was welded to the center of a 12-inch-diameter aluminum disk. This tubing would slide down over the top of the 2-inch-o.d. fiberglass mast. The spokes could then be bolted on the top of this disk.

The scale-model spokes needed to be 0.125 inches in diameter and 1.5 feet long. Not having any #8 wire (0.128-inch-diameter), we decided to use the #12 wire instead, knowing this would provide slightly less top-hat capacitance. A 3-inch-diameter piece of copperclad circuit board became the scale-model disk, and a piece of 1/2-inch thin-wall copper pipe became the scale-model mounting tube. All of these scale-model pieces were soldered in place.

The scale-model loading coil was wound on a 1/2-inch-diameter wood dowel rod. After much discussion, Willie and I decided to start out with 150 turns. We estimated that this would be a few turns too many—but it is always easier to take off than to add on. The quarter-scale model was assembled and mounted such that the capacitance hat was exactly 6 feet 3 inches above a good ground, this being a radial ground system consisting of 32 radials varying in length from 20 to 45 feet. These were the maximum lengths possible, without encroaching on the XYL's flower beds or the neighbors' yards.

Using a grid-dip oscillator, we determined that the resonant frequency was a little too low, the target being 7.2 MHz. After several cycles of "remove a few turns and try again," we ended up with 111 turns. The next step was to see how well the antenna performed, so we connected some RG-8 coax cable from the scale-model antenna and ground system to my HF transceiver. All indications were that we hit everything right on the money. The impedance was quite low (swr approximately 4:1), but with the aid of a coupler I was able to load up to full power.

Since it was getting late in the day, we decided to cease the proceedings. Besides, Willie wanted to see what kind of signal this little antenna would put out over at his house (about a mile away). Willie rushed home and got on the air. Not only did he report an S9 +40 signal, but we also made contact with two other stations, George K7DY in Tucson and Bill W4KFB in Louisville. George gave me a 5-8 report and Bill a 5-9. Needless to say, there was considerable discussion about my miniature antenna.

Next came the "proof of the pudding." Using the material described previously, we assembled the 25-foot full-scale model. Since the quarter-scale model was resonant at 7.2 MHz, we estimated that the same number of turns on the full-scale model loading coil would resonate the antenna at approximately 1.8 MHz, which is too low for practical purposes. After a little discussion, we decided that 105 turns would be about right, but added another five for good measure. This proved to be a mistake because we had to take it all down and remove those five turns.

The full-scale antenna performed about as we had expected. Again, the impedance was quite low. We estimated that the radiation resistance was about 1 Ohm and the ground-loss resistance about 11 Ohms. Willie suggested that I use a 4-to-1 bifilar-wound toroid transformer at the base of the mast to step the impedance up to approximately 50 Ohms. This worked exceptionally well, the swr being 1:1 at the resonant frequency.

After this success, I got a little greedy and decided to add another 20 feet to the height. A 20-foot section of 2.5-inch fiberglass pipe was acquired and plans made to extend the structure accordingly. Naturally, at the insistence of Willie, we had to do the scale modeling again. It was a good thing we did, however, because we discovered that another 10 turns had to be removed from the loading coil to make everything close to the same resonant frequency.

Erecting the 45-foot full-scale model was quite an experience. With Willie holding the base on the ground against the concrete-mounted short mast, I started the usual "walk-up" procedure. After I reached the midpoint, I looked around and discovered the top hat had barely cleared the ground. Due to the antenna's conflict with a small tree, I had to let it back down and start over again. Unfortunately, unknown to us, one of the top-hat spokes was put into a bind and cracked right at the outer mounting bolt. After we moved the structure so that it would clear the tree, back up it went. Willie said that the base of the mast was up about 50 to 60 degrees before the top started up, then it really got with it.

After reaching the vertical, the top hat waved around as if it were mounted on a wet noodle! Having anticipated this undesirable flexibility, I had attached two levels of guy ropes to the mast. After we slipped the mast over the ground post and bolted it in place (another struggle), we adjusted the guy ropes until Willie was satisfied everything was vertical and straight. Eventually, the cracked spoke fell off, but we weren't about to let the antenna back down just to replace one spoke. This reduced the top-hat capacitance, increasing the resonant frequency about 30 kHz—which was where I really wanted it anyway (about 1.885 MHz).

If you want to see a seven-spoke top hat and a 105-turn top-loading coil supported by a 45-foot wet noodle, come on by. It does get me on 160 meters, however. If I were going to do it again, I think I would use either larger diameter fiberglass pipe or, even better, large diameter aluminum tubing for the main part of the mast, then use a short section of fiberglass or PVC pipe for the loading coil. Oh well, hindsight is always better. At any rate, the scale modeling was quite interesting. As Willie said, "Besides, it was FUN!" ■

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The Missing Link?

Work the world with your HT using WB2REM's simplex controller.

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Motivated by feelings that all hams have experienced, I became obsessed with the idea of communicating worldwide with only a hand-held VHF/UHF transceiver. Thus, I designed a remote link that changed my VHF/UHF operations and one that will bring excitement to yours.

Can you picture yourself riding a bicycle in the neighborhood, or even miles away, and QSOing with someone on the other side of the USA or the world? Do you drive a lot and are you tired of the mundane operations of 2 meters but do not have the room for an HF rig? Are you a DX buff and do you have anxiety attacks over missing rare DX stations while you are at work? Then this project is for you!

As a prerequisite for this project you will need a simplex autopatch or similar device, touchtone™ decoder, UHF or VHF transceiver, as well as an HF rig. Knowledge of digital electronics is needed, although I was initially very naive on the subject and learned by trial and error.

My first working link design employed three Radio Shack 22/44-pin printed-circuit-board cards. In addition to related circuitry, over ten relays were spread out among the boards. After further consideration, I employed a 7420 (TTL-4 input NAND gate), which replaced many of my relays. The newest revision, reported in this article, is contained on one Radio Shack 22/44-pin board and will enable you to operate your HF rig at your house by using just your VHF/UHF HT or mobile transceiver.

The simplex link requires a simpatch sampling device. I chose the CES 510SA because of its special access features, especially the line-in-use code option. That option allows you to interrupt a telephone call in progress only by inputting a three-digit touchtone code from your remote transceiver. These codes can be manipulated to activate the link. This link was designed for use with the CES 510SA Revision B, although instructions are given for Revisions C, D, and E. Other types of simplex autopatches can be used as well with special modifications. It is also advisable that you use a fast-switching VHF/UHF rig in conjunction with the simpatch. Besides the HF rig (which can be any type), a DTMF decoder (like a Silicon System SS 202P) will be needed. Outputs of the DTMF decoder should be 5 volts.

The block diagram (Fig. 1) illustrates the operations of the simplex link system. Basically, a touchtone signal originating from your remote transceiver is received by the VHF/UHF transceiver connected to the link. The signal is passed through the touchtone decoder, causing a voltage shift from +5 V to ground while the touchtone is present. These voltage shifts in turn send messages to the ICs and relays, which activate the link.

The link performs a number of functions. It supplies power to your low-band rigs and controls your mode of operation. The link turns on in a receive-only mode. This will allow you to chat on your VHF/UHF HT while monitoring the HF band in the background. The patch silences the HF receiver audio when you transmit on your HT. Through touchtone commands you can switch into a transceive mode. Here, all signals received by your VHF/UHF transceiver are simultaneously transmitted on the HF band. A beep follows your transmission to verify your HF transmission. Finally, the link switches out the phone line and reinserts the HF-receiver audio into its place.

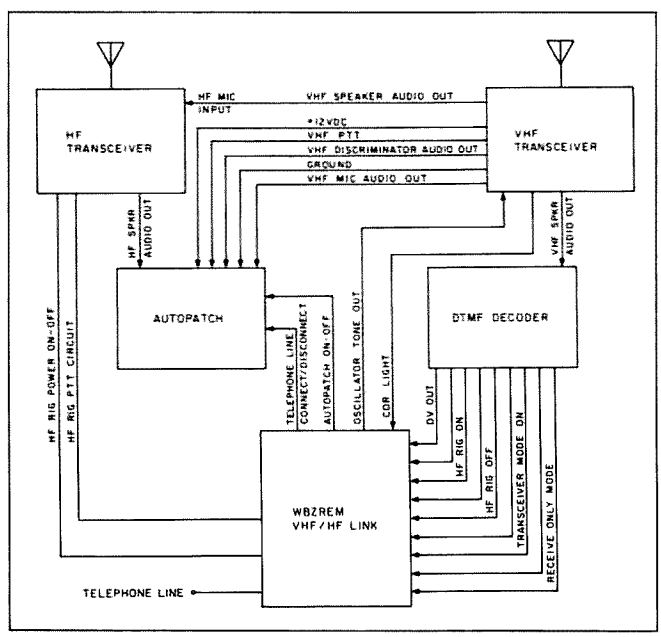


Fig. 1. Block diagram.

Circuitry

Electrically, the link consists of two 2-tone latches composed of: three 7400s, a 7420, two 556 timers, an oscillator, three 5-volt relays, and one 12-volt relay. All components are mounted on the Radio Shack 22/44-pin board except for RL1, the 12-V relay. Photo A shows how tight the fit is. All ICs and relays should be mounted as close to each other as possible on the 22/44-pin board. One of the 2-tone latched circuits is used to trigger the 4PDT relay (RL1), which turns the HF rig on, disconnects the telephone line, and inserts HF-re-

ceiver audio. The other switches the link from receive to transceive mode.

At the central core of the link is the 7420 (U5), a 4-input NAND gate. When each of the four inputs of this IC simultaneously receives a +5-volt signal, a relay (RL3) is activated, which triggers the PTT switch of your HF rig.

Pin 1 of the 7420 is connected to the output (pin 3) of one of the 2-tone latches (U3). The latch output is at ground potential until triggered by the transceive-mode touchtone access code. The output then shifts to +5 volts. LEDs connected to the inputs of the 7420 indicate the presence of input signals. In returning to receive-only mode, the output of U3 drops back down to ground.

Pin 2 of the 7420 is connected to the output of a 74123 (a monostable multivibrator). It sounds obscene but is merely a timer. In the link this output is normally at +5 volts, but it shifts to ground potential for one second when triggered by DV. DV is a line that comes out of most touchtone decoders and responds to every valid touchtone by shifting to +5 volts for as long as a tone is present. This circuitry in the link is used to mute the transmission of touchtones over the HF band and, in effect, momentarily takes the HF rig out of transmit when a touchtone is decoded. I have found that DV and/or the decoder is

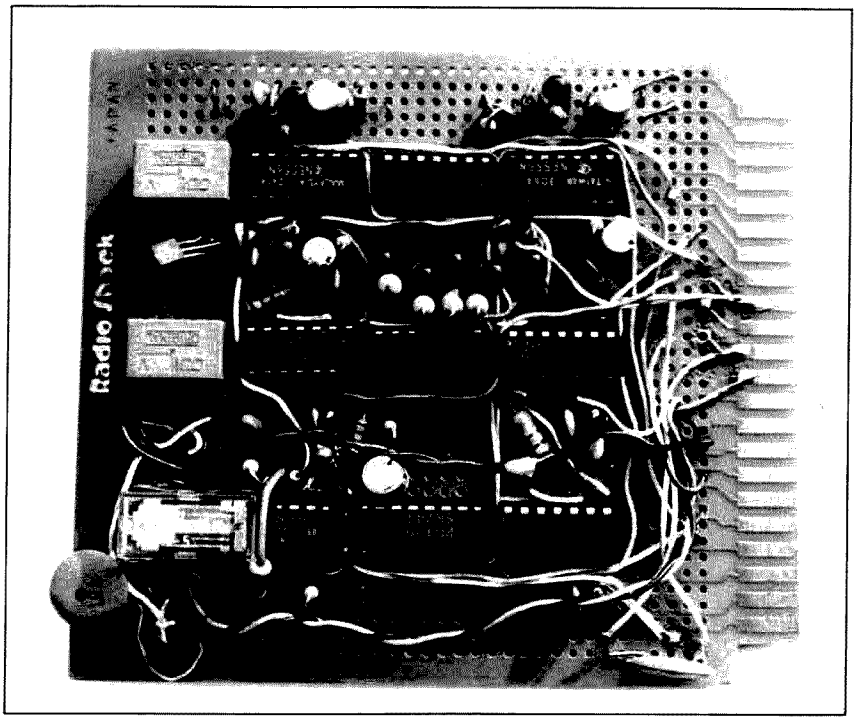


Photo A. A complete simplex link on one tiny board.

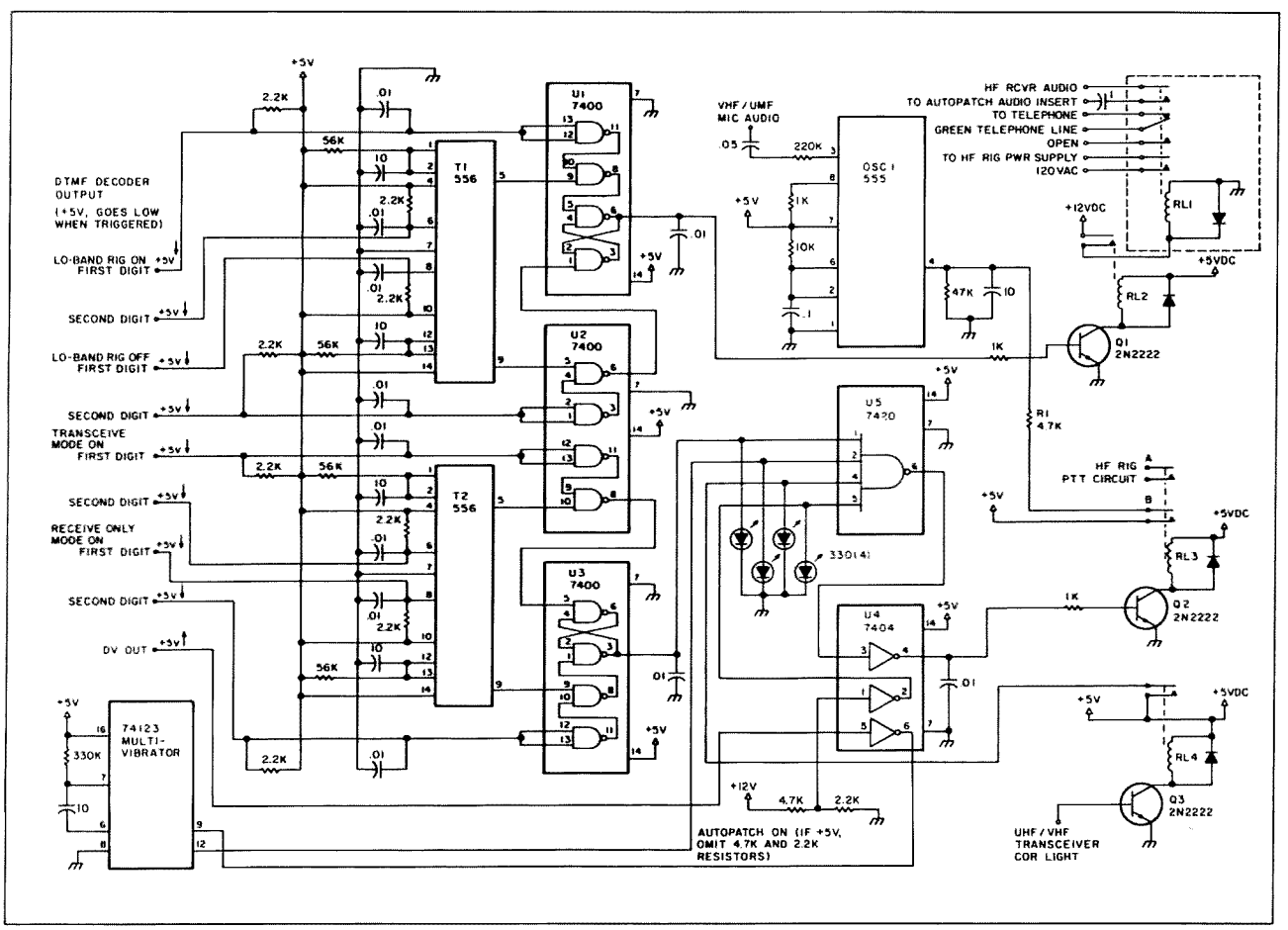


Fig. 2. Schematic of the WB2REM low-band link.

Parts List

1	1 uF non-polarized electrolytic	.79
1	.1 uF	.25
1	.05 uF	.25
5	10 uF tantalum	.69 ea.
12	.01 uF	.10 ea.
9	2.2k, 1/4 W	.10 ea.
4	56k, 1/4 W	.10 ea.
1	330k, 1/4 W	.10
1	220k, 1/4 W	.10
4	330 Ohms, 1/4 W	.10 ea.
1	10k, 1/4 W	.10
3	1k, 1/4 W	.10 ea.
2	4.7k, 1/4 W	.10 ea
1	47k, 1/4 W	.10
4	1N4004 diodes	.15 ea.
4	Red LEDs	.20 ea.
3	2N2222 transistors (RS 276-1617)	$1.98/pkg.
2	556 ICs (T1, T2) (RS 276-1728)	$1.49 ea.
1	74123 IC	$1.50
3	7400 ICs (U1, U2, U3) (RS 276-1801)	.89 ea.
1	7404 IC (U4) (RS 276-1802)	.99
1	7420 IC (U5)	.99
1	555 IC (OSC1) (RS 276-1723)	$1.19
7	14-DIP sockets	.20 ea.
1	16-DIP socket	.20
1	8-DIP socket	.20
2	5-V, 2-A SPDT relays (RL2–RL4) (RS 275-243)	$2.49 ea.
1	5-V, 1-A DPDT relay (RL3) (RS 275-215)	$3.99
1	12-V, 10-A 4PDT relay (RL1) (RS 275-218)	$5.49
1	22/44-pin circuit board (RS 276-154a)	$2.99

most susceptible to rf interference. If rapid switching of the low-band relay occurs, shield the decoder from rf.

Pin 5 of the 7420 is connected to your simplex-autopatch in-use voltage. In the CES 510SA, this point can be tapped off of the positive side of R18 in Revision B (R29 in Revisions C, D, and E). At R18, +12 volts is present when the patch is in "standby." When activated, it drops to ground potential. This shift is inverted by the 7404 and applies 5 V to pin 5 of the 7420.

Finally, from a connection to the squelch, COR light, or other carrier-sensing device coming from your VHF/UHF transceiver, you will need to use that voltage to drive a 5-V relay. This relay's normally open contacts will then apply 5 V on pin 4 of the 7420 whenever a signal breaks the squelch of your VHF/UHF rig.

Once all four conditions are met, relay RL3 will short the push-to-talk wires of your HF rig and put it into transmit. A beep will come back after you stop transmitting. This beep is generated by the 555 (OSC1) oscillator. The length of the beep can be changed by varying *R1 or C1*, the tone pitch by *R2 or C2*, and volume by changing R3. If you cannot immediately hear the beep, open your remote transceiver's squelch. The beep may be coming back too quickly.

Hookup

Refer to Fig. 1, the block diagram. To interconnect your VHF/UHF base station to the simplex autopatch and HF rig, you will need very good shielded wire. This is to reduce any floating rf, which could adversely affect your circuitry. If you have problems with rf, try putting a .01- or .1-uF capacitor to ground at critical points like the outputs from the decoder and IC outputs.

Your first step in connecting the link is to follow the factory instructions for installation of your simplex autopatch to your VHF/UHF rig. Next, you should connect a shielded wire from the receiver audio of your VHF/UHF rig and run it to the microphone audio line of your low-band rig. I was able to make this connection directly, but you may need an audio transformer in the circuit. Next, run shielded wire from the HF-rig push-to-talk line to the normally open and common contacts of the DPDT (RL3) relay. From the receiver audio line of the HF rig, run a shielded wire to the audio insert point in your simplex autopatch. This is done through a 1-uF capacitor. In the CES 510SA Revision B, this connection is made between T1 and C18 (C22 in Revisions C, D, and E).

Testing the Link

To activate the link, key in the "line in use" and "autopatch on" touchtone codes on your VHF/UHF remote transceiver and set your decoder's output with them. These codes cause relay RL2 to switch relay RL1. Relay RL1 has several functions: It supplies power to your HF rig, disconnects the telephone line from the autopatch, and switches the HF-rig receiver audio into the autopatch. The HF audio will be heard through the normal simplex autopatch sampling method. Adjust the audio level of your HF rig by listening on your remote transceiver (HT). You will find that the volume adjustment should be lower than normal listening level. To go into transceive mode, key in your designated touchtone codes. There will be a slight delay (1/4 to 1/2 second) and your HF PTT will be activated. Talk into your remote transceiver (HT) and adjust your low-band microphone level at the same time as reducing or increasing the VHF/UHF rig receiver level. This will ensure a proper HF-band modulation level. If your microphone gain is too high, it may affect the operation of the decoder. So, if you notice that the touchtones aren't muting on the HF band, lower your HF-band microphone gain and/or increase VHF/UHF receiver gain.

It must be noted that, in this type of link operation, extreme courtesy should be exercised. Since you will probably be able to operate only on one HF frequency (unless you have a computer-controlled transceiver), you should always ask if the frequency is in use, as in normal operation. This applies to your VHF/UHF simplex frequency as well.

Secondly, in accordance with FCC rules and regulations, you should have a separate control link to your setup. I use a telephone-line control system, which you can purchase at Radio Shack or Sears. It turns my complete station's electricity on/off by signals sent through the telephone line.

Conclusion

For the last couple of years I have enjoyed many contacts through the link, all of which have been exciting experiences. I have gone auto mobile, bicycle mobile, walking mobile, barbershop portable, and dentist-chair portable.[*"Mumph glumph, rumph, aaack, ouch—Please rinse and spit" echoing through the HF bands.—Ed.*] The implications for use in emergency situations, retirement communities, and apartments are unlimited.

I view linking as a new frontier in amateur radio. The possibilities are limitless as to where, how, and with whom it can be done. You can link 220 MHz to 2 meters, or 440 FM to 15-meter SSB. Most importantly, it is done on simplex and does not tie up a repeater.

So get out in the air, take a ride in the country, or just lie on the beach because now you can rest assured that if you get the sudden urge to call CQ DX, your big rig is as close as your HT.

At this time I would like to thank Dick Spair K2ASG, whose expert skills regarding linking provided me with the backbone for writing this article. I would also like to thank Jerry Lutin N2ERB, who painstakingly transcribed my chicken-scratch schematics into a work of art. In addition, I would like to acknowledge Dick Maly N2COH, Mark Winderman WA2HCS, and Lou Cordas K2EWT for their invaluable help. ■

C. L. Houghton
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San Diego CA 92119

Dishing It Out On 10 GHz

Learn how to build simple feed systems for microwave antennas. (Includes an explanation of the mysterious "baggies" effect.)

I have always been mystified by antennas and feeds for use on microwave frequencies. I used to think that most of the technology that is needed is far too advanced for me to tackle—and this held me back from constructing units for myself. The black-box technology held the most mystery for me. I hope in this article to dispel any fears on the very special black-box designs needed to make these antennas work. The techniques that I will present cover designs I have built and used. While there is a degree of black-box magic going on, it did not prevent me from obtaining some very efficient antennas with very simple tools.

I started this project by constructing an antenna feed for 10 GHz before I even contemplated any receiver or transmitter, since I had obtained the piece of waveguide first. Being a scrounger, I couldn't refuse a part that could be put to use sooner or later.

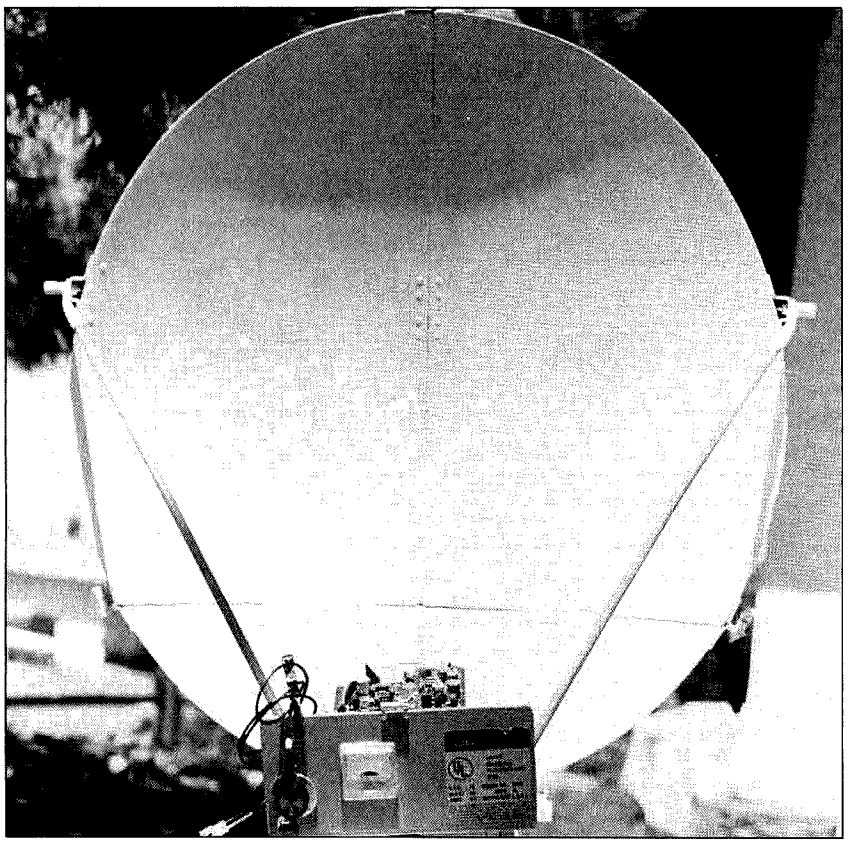


Photo A. Off-center-feed 10-GHz dish with original transceiver mounted at focus. Used for Mount Soledad to Mount Helix contacts.

Dipole Feed

The first feed that I constructed was a simple dipole feed equipped with a reflector spaced behind the driven element. This feed was constructed from one shown in the *RSGB VHF Handbook*. Fig. 1 shows the details. The actual construction of this feed was started on a scrap piece of waveguide 16 (WG-16), which has dimensions of .5 by 1 inch outside and .4 by .9 inches inside. This piece of waveguide was cut back for a distance of 2 inches from the front with a .125-inch edge lip clearance. The triangular area was cut away with a hacksaw and then filed down to the scribe marks as shown in Fig. 1. This vee cut is made in the .5-inch side of the waveguide. When you have removed the triangular piece from both ends of the waveguide, bend the upper and lower sections together to form a duck-bill tapered end. Move both upper and lower sections an equal amount.

In the dead center of the point of contact, a one-quarter-inch slot is cut into the front face of the vee that is now formed together. This slot has a width of about .064 inches ± .002 inches. The depth of the slot is .250 inches. Into this slot is placed a 1-inch-wide, .050-inch-thick piece of brass 1.250 inches long. The assembly is hard-soldered and all dimensions are checked for accuracy. All excess solder is removed from the inside of the guide as well as from the pieces—use as little solder as possible to make the cleanup job easier.

After you are satisfied that the parts have not shifted during soldering, you can drill the holes for the dipole and reflector in the .050-inch piece of brass. My elements were made from a .75-inch length of .125-inch brass stock obtained at a model train shop. I made the pieces longer than necessary to facilitate soldering and cleanup. In this way I only had to file them, after checking them with a caliper or micrometer to determine when

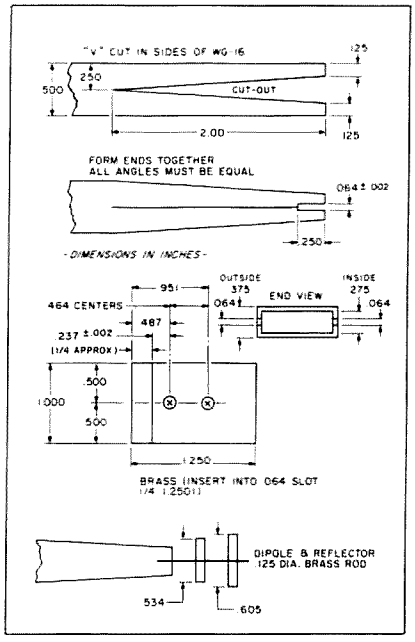


Fig. 1. Construction details for the 10-GHz dipole feed.

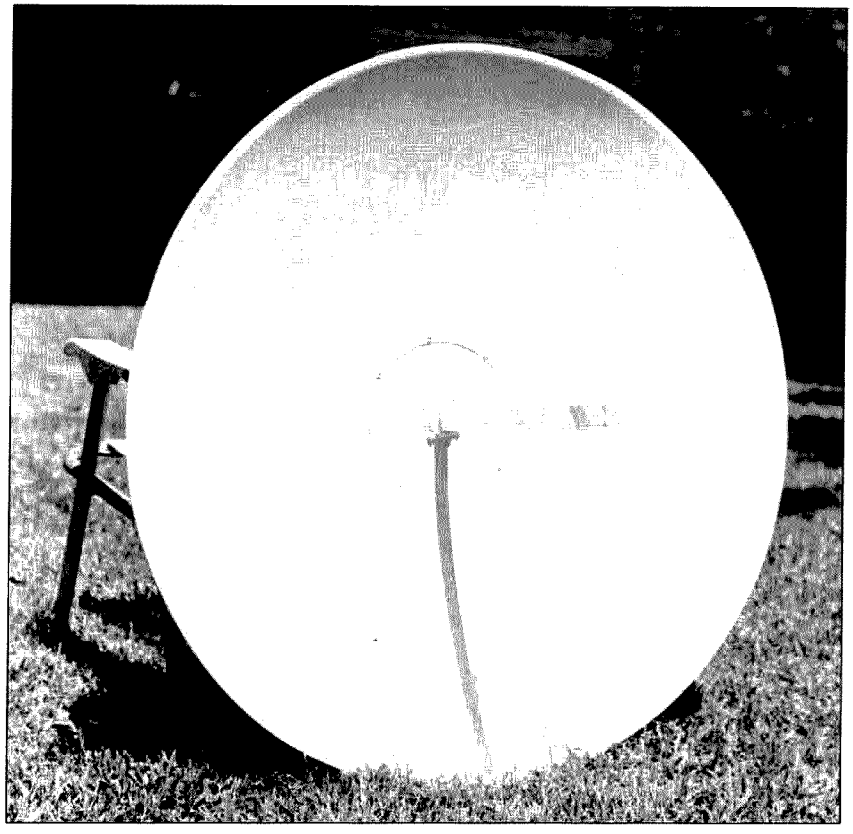


Photo B. 10-GHz dish antenna with dipole feed and dielectric resonator (plastic bag) in place.

they were cut to the proper length. Make checks often, as it is surprising how much material can be removed from this brass stock, and also check the spacing to the center stock to ensure that the elements are balanced in length.

Parabolic Dish Feed

I must have waited almost two years for other parts of the system to come into play before I was able to adapt the previous feed to a parabolic dish. I had been looking out for one for a long time without much success. I had even eyed the Sears Snowcoaster as a possible dish, but regarded the shape as too inefficient on close evaluation. Just not the right shape—close, but not right. I looked at many of the construction articles on dish antennas and thought about making one, but never did. I guess I was looking for the perfect inexpensive available dish antenna.

I finally found the perfect dish in one of the most unlikely places, but I came close to missing it completely. Only the intervention of a friend who was parked in a nearby truck prevented it. As I guided him out of a tight spot in a parking lot, I spotted the dishes. In the trash dumpster were two light reflectors, the type you see hanging from most high-school gyms for lighting the basketball court. The price made the acquisition even more desirable! They were 30 inches in diameter and had a large hole in their center. A small piece of metal could take care of that very easily. When I brought the two very dirty reflectors into work, some of my fellow hams thought I had lost some, if not all, of my marbles. Little did they know what madness was at work. After all, being a scrounger, one must be ever alert.

I was impressed by the curvature and the simplistic idea that if a reflector was made to do a good job with a light bulb, why not at lower frequencies, say 10 GHz? The depth of the curve from the outer edge to the center was 4.75 inches. With a diameter of 30 inches, the focus is equal to the diameter squared divided by 16 times the depth. In this case, the focus would be placed at approximately 11.8 inches. I took the dishes home and cut an 8.5-inch piece of round aluminum to cover the hole and soon was mounting the feed that I had made so long ago.

Dipole Feed Trials

I tested the dipole feed in my garage and in my backyard and the results were very encouraging. The antenna showed a very narrow beamwidth and quite a lot of improvement in gain over the 18-dB horn that I was comparing it to. Calculations showed that if all were operating well, I should expect about 35 dB of gain from this antenna system. I did not get a chance to add a matching screw network, as the gas tank used for the soldering operation was in need of a refill. See Fig. 2 for details on the screw tuner used to improve the match on waveguide 16.

Field Tests

My partner in this venture, Kerry Blank N6IZW, and I had tested the system performance with our transceivers located over short paths of about two to five miles, and we were eager to try a longer path. Kerry traveled to Mount Soledad on his lunch hour and I went to Mount Helix, as both these areas were within a short distance of our respective locations. The two locations are about 16 miles apart. While not record-setting distances, they did offer further field trials of our systems and provided a lot of enjoyment. Both of us set up similar systems using our off-center-feed dish antennas that were originally military 4-GHz antennas. (See Photo A for the off-center-feed antenna mounted with our original GUNN transceiver and small horn aimed at the reflector.)

We removed their feedhorns and replaced them with our homemade 10-GHz transceivers, and used a very small feedhorn to drive the dishes at each end of the path. We were able to make contact on 10 GHz, but I was experiencing very heavy FM broadcast interference on my end. Kerry and I were able to communicate with our systems and had approximately 25 microvolts of signal being received at each end of the path.

It was hard to keep the antennas aimed at each other due to the wind and the lightweight tripods we were using, but we kept in contact. The interference that I was having made the phase-locked detector circuit in the receiver search for a zero-discriminator reading, probably competing with or capturing the commercial FM station. When we were zeroed in, communication was crystal clear, but the slightest movement caused the FM signal to overtake us and destroy our contact.

The transceiver at that time was completely unshielded and open to rf pickup. The ground foil provided a very small measure of protec-

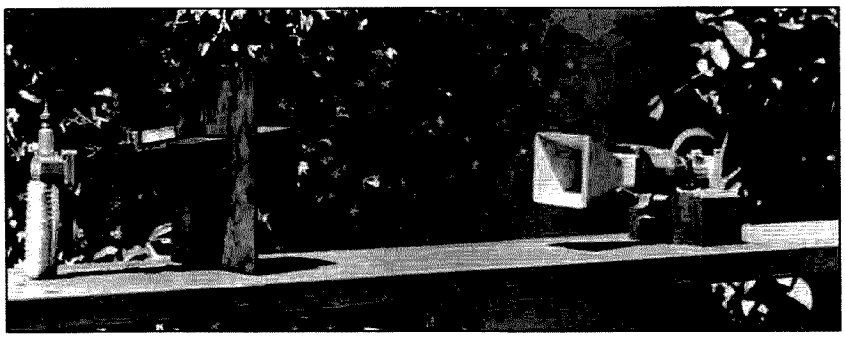
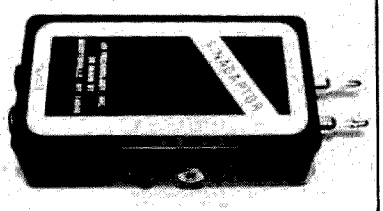


Photo C. Horn-antenna test adjustment range. A suitable distance would be 10–20 feet for small horns.

tion, but in the same area with a high-power transmitter (FM) it wasn't enough. I have yet to enclose my transceiver in a shield. (I'm waiting to find some diecast boxes.)

At the conclusion of our test, I turned off my transceiver and placed the light reflector on the tripod and turned it on in the direction of Kerry on Mount Soledad. He reported a copyable signal, but not what we had expected. I was disappointed, but when the feed was properly tuned I was sure it would perform quite well. I started to pack up. I put the traveling plastic bag over the open end of the feed and taped it into place when Kerry called me on two meters. I had forgotten to turn off my transmitter on 10 GHz, and I was now pegging the meter on his receiver. LIKE, *WOW*, MAN! The plastic bag was providing the required matching and improved the antenna's performance by a factor of 3 to 4 over the previous signal reports.

I removed the bag and the signals dropped. Replacing the bag to the end of the feed did the trick. Studying this new phenomenon, it was learned that what we had accomplished through sheer accident was dielectric loading of the antenna. I was surprised to learn that materials that are very good insulators at VHF and higher turn into something else or at least have a very big effect at microwave frequencies. Enter the black-box theory. Photo B shows the dish and its plastic bag, our dielectric resonator. Fig. 2 shows how a plastic cover can be used to tune a slot antenna, a very good example of dielectric loading. I don't know what I would have done without the *RSGB VHF Handbook* as a reference on this and other topics.



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Horn Antennas and Feeds

The horn is by itself a feed and also a very good radiating antenna. I am using a very small horn to feed the off-center-feed dish, as shown in the photographs. The horn used is part of the Solfan Intrusion Alarm device that was purchased at one of our local swap meets. The primary advantage in using a horn is its almost perfect match over a wide frequency range and its easy construction. This feed is also very impervious to errors in its construction. A horn is best described as a piece of waveguide with its end flared out, with somewhat the same ratio of width to length. As an example, a horn 6 inches in length with an opening of about 3.5 by 5 inches provides a gain of about 18 dB at 10 GHz. Photo C shows two horn antennas pointing at each other on an antenna test range. Although the distance is much too close as shown here, the operation of test evaluation is the same. The large horn has a detector mount and is coupled to a meter to measure relative signal strength received to tune up systems.

The most expensive part of construction of horns is the waveguide flange used to couple to the waveguide. I have usually purchased scrap pieces of waveguide built for some weird purpose, only to sweat the brased flange off and resue it on another project. Some real nondescript pieces of waveguide with custom bends can be had for very little

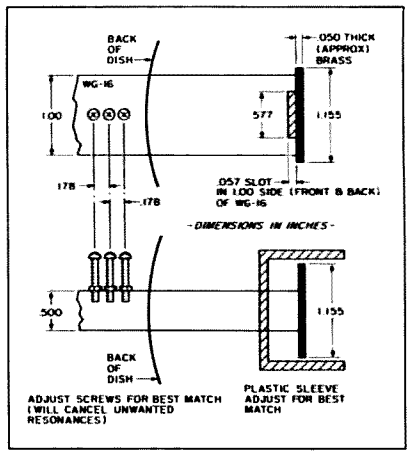


Fig. 2. A slot-feed method for 10 GHz.

money, usually about 75 cents per flange. Remember that if the guide is brass scrap, it is currently selling for about 60 cents a pound—another consideration.

When I sweat the flanges off the waveguide, I place the guide in a vise and let the flange fall into a soft box of sand. Sometimes it is necessary to use gentle tapping to make the flange come off. Do not put the flange in a vise and pull off the waveguide, as you will distort the flange; I found out the hard way. You cannot fix a distorted flange, but you can sell it for 60 cents a pound.

Slot Feed

I have constructed a slot feed that is very easy to make—sort of a one-evening project. A hacksaw, files, and a small piece of brass are all that you need. See the design in Fig. 2 for details. This feed also uses the plastic feed-tuning (dielectric-loading) end-matching device. I have recently built this device, and preliminary testing indicates that its performance is quite good. One word on painting: Cover the slot so that paint does not get into the guide. I usually use a small wood block because it is easily removed after the paint is completely dry. I have found most enamels to be transparent at this frequency. Do not use any paint that has a fleck or a metallic part to its color. I have not tried them, but suspect they will offer some detriment to operation at 10 GHz.

I hope that I have given you some ideas on various feeds that can be made with ordinary hand tools. I do not feel that any special techniques are needed, just a little care in measuring and construction to keep the parts balanced. The construction of these feeds and antennas, when coupled with the transceivers that you have made, should provide many hours of enjoyment. I still delight in the operation on this band and hope that others will have as much fun on 10 GHz as I have.

I will make the 10-GHz GUNN diodes available to amateurs for $5 each postpaid in the continental U.S. These diodes provide an output of 50 to 100 mW; they are about .3 inches long and look like a 4/40 screw without a head. ■

John V. McAdams Jr. WA2OLZ
822 Springfield Avenue
Cranford NJ 07016

High and Dry

With a little plumbing know-how, WA2OLZ brought his antenna rotator out of the rain and into his attic. (Step 1: Cut a hole in your roof. . .)

How do I get a directional antenna installed in a community that has a building code prohibiting the installation of towers? No doubt this question has been asked many times by hams, but this was my first outing into the world of beam installation vs. the town fathers. The first answer that came to mind was to purchase a short "tripod" tower and mount it on the roof. There were a couple of drawbacks to this scheme, however. First, the town could well give me grief over this solution in that "a tower is a tower," and the tripod could be outlawed. Second, I have heard many horror stories about these mini-towers folding under wind pressure and damaging the roof of the house. This just did not seem to be the answer, and the obvious alternative, a chimney mount, didn't seem appropriate for a three-element triband antenna.

While discussing the problem with me on the local repeater, WA2GFO suggested that if I could somehow mount the antenna on the roof without using a tower at all, the objections of the town would be overcome and I'd have an operable antenna system. The solution was to mount the antenna rotator in the attic with a concentric length of plumber's "black pipe" going through the roof to the antenna. The added advantages of removing the rotator from the harmful effects of the weather and making it accessible from indoors for repairs and adjustment were bonuses—for which I was grateful when the rotator developed a problem when the weather outside was below zero. If the rotator had been mounted outside, it would have been out of service until the following spring. Since it was inside, it was a simple matter to effect repairs in comfort.

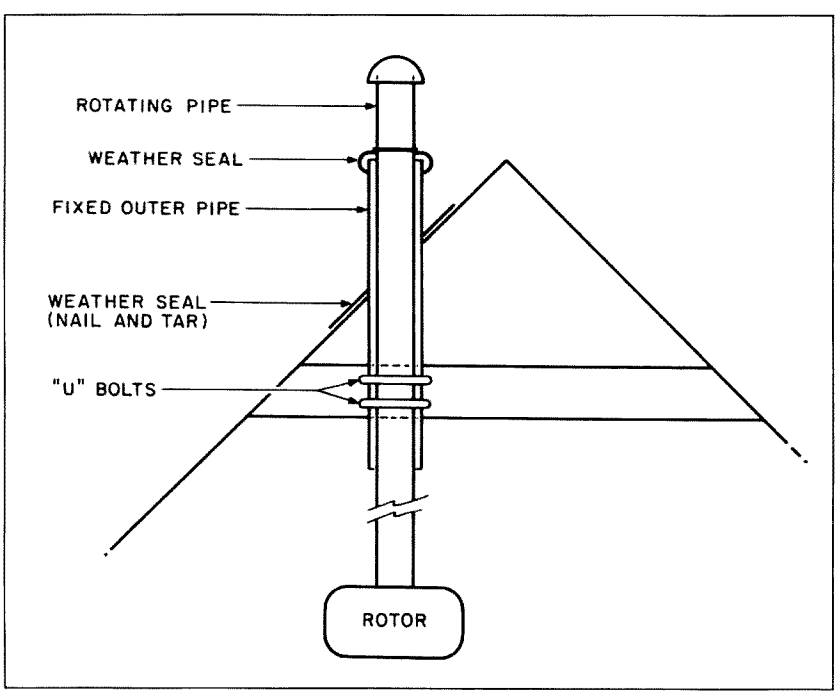


Fig. 1. WA2OLZ's through-the-roof mounting system protects your rotator from the elements and circumvents restrictive tower ordinances.

The basis of the installation is to provide a "pipe within a pipe." A hole of the appropriate diameter is cut in the roof by means of a hole saw on a hand drill. The outer pipe is fixed to the roof cross members from inside with U-bolts, and is permitted to extend outside the roof less than one foot. The inner pipe rotates freely within the outer pipe and is bolted to the rotator in the normal manner (see Fig. 1). The original plan called for a thorough application of heavy grease to the inner pipe so that it would rotate smoothly, but this was unnecessary as the pipes are sized such that there is no significant rotational drag.

I was most anxious to ensure that the installation was absolutely watertight—a new roof had been installed on the house the previous year and I had no desire to do that job again! The answer was really quite simple. Every house has a plumbing vent pipe poking through the roof. If I could duplicate the method used to seal this pipe to the elements, there should be no problem with leakage (I hoped). The local plumbing-supply house carried a device with a flexible rubber sleeve mounted to an aluminum plate for just this purpose. The sleeve is designed to provide a weather-tight seal around a vent pipe, and the aluminum plate is secured with roofing nails and roofing tar to the asphalt shingle roof. This was perfect for sealing the outer pipe, but the problem still remained of weatherproofing the small space between the inner and outer pipes.

It so happens that the rubber sleeves are available in various sizes to match the different sizes of "black pipe" commonly used as plumbing vents. So long as the inner and outer pipes are of adjacent sizes, the rubber boot that fits the outside diameter of the inner pipe will also match perfectly the inside diameter of the outer pipe. The top (exposed)

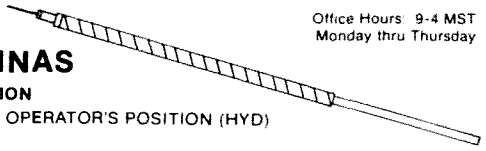
end of the inner pipe was threaded by the plumbing supply house and sealed with a cap designed for this purpose. An additional short length of pipe could optionally be added at this point via a plumbing coupling should it be desired to stack a smaller (2-meter) beam above the primary antenna. This has provided an absolutely weather-tight seal at WA2OLZ through heavy downpours, high wind, and significant snow accumulation.

The very able assistance of N2ESX resulted in the installation of the antenna in only one afternoon. This is definitely not a one-person job! Be certain to observe proper safety techniques and have a safety man in attendance whenever working on the roof.

The antenna is mounted only three feet above the roof in this installation but has generated excellent results including an S9 +20 report from a USSR station in a heavy pileup the first time it was put into service. No doubt even better results could be obtained by using a longer length of inner pipe in order to raise the antenna to a better altitude. I was reluctant to do so, however, for fear of generating excessive side loads on the outer pipe and resultant binding and possible damage to the rotator.

This installation has exceeded my expectations at WA2OLZ and did not incur the wrath of the township powers. In fact, the low height above the roof makes the antenna almost invisible from the street unless you are looking for it. ■

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The Ramada Radiator

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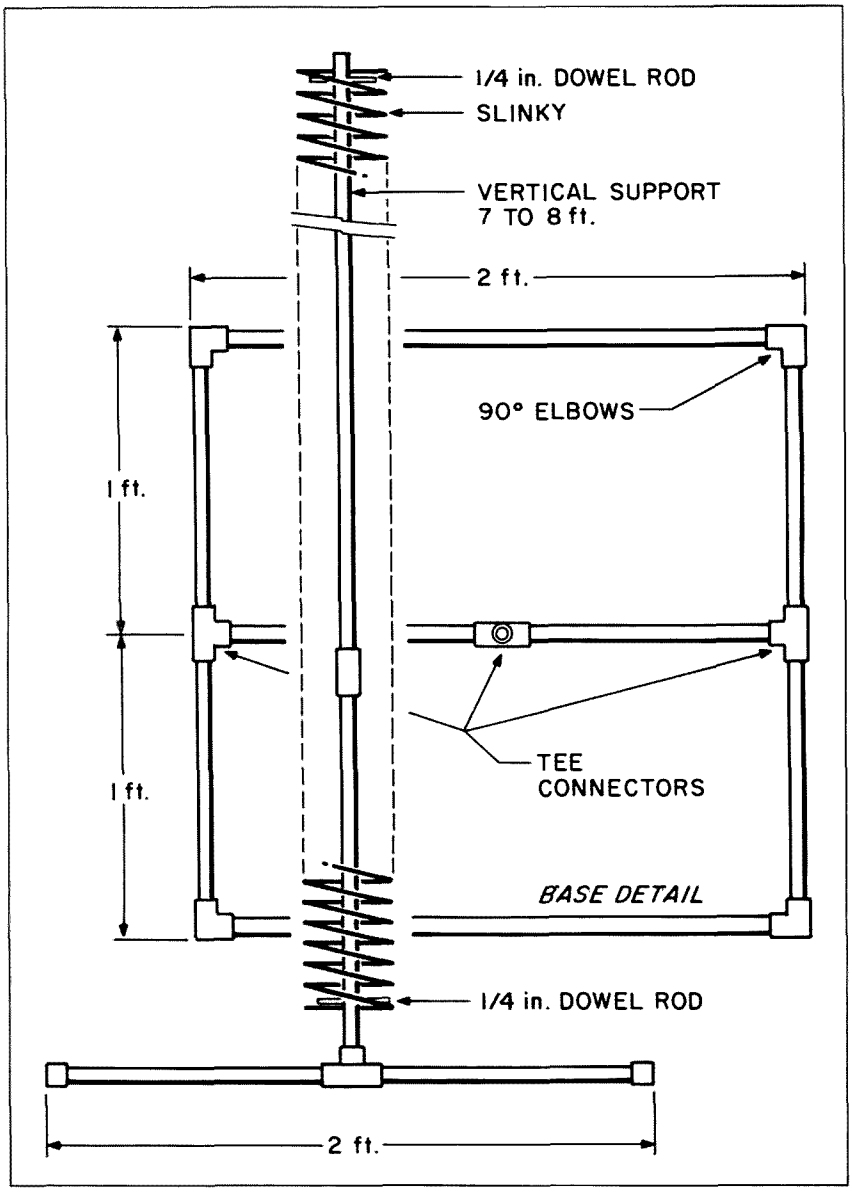


Fig. 1. The Springy portable antenna.

How would you like to have a portable antenna that works like a charm on all the HF ham bands, weighs only a couple of pounds, can be erected anywhere in a matter of minutes, and costs less than $10? Impossible, you say? Well, read on, because the antenna I am about to describe is all that and more.

My job requires lots of travel and I like to operate HF. This can be very challenging and frustrating at the same time. Every new motel room requires a different setup, with much time wasted trying to adjust different lengths of wire with the tuner to find a combination that gives the lowest swr. I enjoy operating QRP CW with an Argonaut and a Century 22, so antenna efficiency is very important. I have tried every type and combination of indoor antenna imaginable over the years, and have found that this little gem works better than most. Best of all, it gives constant loading combinations to my tuner so that I don't have to waste time trying to retune every time I set up.

As you can see, this wonder antenna, the Springy, is built around a toy Slinky™ and two 10-foot lengths of 3/4-inch PVC plastic pipe. You also will need four 90-degree elbows, three T-connectors, and two straight connectors for the 3/4-inch pipe, plus two pieces of 1/4-inch dowel rod four inches long.

Begin construction of the antenna base by cutting one of the 10-foot pipes into two 2-foot and six 1-foot lengths. Construct the base as illustrated in Fig. 1. You do not need to glue any of these joints as they fit very tightly—and once glued, they cannot be taken apart.

Cut the second 10-foot pipe into two 3-foot, one 2-foot, and two 1-foot lengths. Use a combination of these sections to construct the vertical element of the antenna stand. The different lengths of pipe will allow you to vary the height of the vertical element to fit the ceiling height of different rooms.

Drill a 1/4-inch hole through the vertical element at each end. These holes will be used to hold the wooden dowels that support the

Slinky and keep it stretched out. As you can see from the illustration, the Slinky is placed over the vertical pipe and just hangs down.

A tuner will be required to load the Springy. I built mine out of old broadcast variable capacitors and some coil stock I had in my junk box. Any of the smaller commercial tuners will work, but for portable operation, the smaller the better.

With my tuner I am able to load the Springy, with a flat swr, on all bands. I use a small length of wire with an alligator clip at one end to clip onto the bottom of the Slinky. The tuner sits at the base and is connected to the rig via a small length of coax.

I have found the settings on the tuner to be almost the same every time I set the antenna up. There will be slight differences caused by different surroundings, but some minor adjustments are all it takes to get a flat swr. The Springy seems to be broadbanded, and very little adjustment is needed when changing frequencies inside a band.

I made a small case from 1/4-inch plywood to carry the plastic stand, Slinky, tuner, and lengths of coax. The first thing I do when arriving at a new location is to set the antenna up, connect the Argonaut or the Century 22, and get on the air. I keep the tuner-setting combinations on a small file card in the box with the antenna. Many times I don't have to do any touch-up at all to get a perfectly flat swr. One point to watch when adjusting for the best swr: Wait until the Slinky has stopped bouncing after you hang it from the vertical stand. The bouncing changes the inductance as the distance between the coils of wires changes, and trying to get a good reading is very difficult, to say the least!

If you are looking for a great little portable antenna to use while on vacation or any time you hit the road, the Springy will do the trick. My first QSO with it was from my kitchen, with a W5 in Texas, on 40 meters. As he gave me an RST of 589—and I was running only about 20 Watts with the Century 22—I knew I had a winner.

"It fits in your pocket, is inexpensive, and if the band goes dead, you can always play with the thing."

I usually carry a small roll of wire with an alligator clip on one end to ground the tuner to the cold-water pipes in the hotel room. This seems to help my signal get out and at the same time makes the Springy more broadbanded.

If you are the adventurous type who likes to operate portable outdoors, give the Springy a try by hanging it from a tree limb with a rope. I've found it works very well suspended about 10 feet above the ground. Drive a stake into the ground directly under the antenna and tie a piece of string or other nonconducting material to it to keep the Slinky taut. Load it from the bottom as you would any vertical.

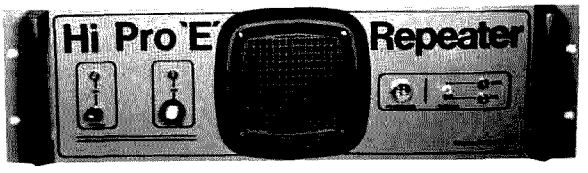
The little Springy antenna works great outdoors or in, so give it a try the next time you need a portable, allband antenna. It fits in your pocket, is inexpensive, and if the band goes dead, you can always play with the thing.

I should include one word of caution concerning the use of this antenna. Its use does tend to attract attention, especially when hung from a tree in public camping areas. If being stared at and having your sanity questioned by everyone in camp bothers you, don't use this antenna. If having people suddenly grab their children by the arm when within 50 yards of you and moving them to the other side of the park disturbs you, don't use this antenna. But—if you want to have fun on the air from just about any location, give the Springy a try. After all, most people thought Marconi, Edison, and the Wright brothers were a little strange, too, so you are in good company! ■

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The Texas Tango Antenna

Ticked off at traps, K5BTV stumbles onto a 75/40m tuned-stub dipole.

Over the years I've tried many types of antennas for 75 and 40 meters. These have included verticals, folded dipoles, inverted vees, and trapped antennas—plus a few that still defy description. Several common requirements have emerged through this work: The antenna has to be confined within my property line (90 feet x 120 feet) and the wires kept to a minimum to keep the neighbors and XYL at bay. But most importantly, the antenna has to perform well.

The addition of the WARC bands presented a new challenge. Until I could develop a suitable yagi to cover the bands above 40 meters, a trapped inverted vee seemed the best way to become active on the new bands. So a three-band trapped inverted vee was constructed to cover 75, 40, and 30 meters using coaxial-cable coils on PVC tubing.

The trapped inverted vee was erected at 40 feet on my tower. On 75 meters, the operating frequency limit to stay within a 2:1 swr was approximately 50 kHz; on 40 and 30 meters it was about 25 kHz. The coil-and-capacitor trap impedance is responsible for the bandwidth of each band, as described in an article by John Grebenkemper (*QST*, May, 1985). But having already constructed the antenna, I knew I would have to construct new traps if I desired more bandwidth.

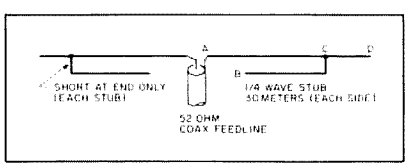


Fig. 1. Quarter-wave stub traps on a half-wave dipole. For a 75/30-meter antenna, the distance from A to D = 234/3.825 = 61 feet. The distance from A to B = B to C = 234/10.115 = 23 feet.

While enjoying the patio and thinking about the disadvantages of the coaxial traps (moisture penetration, arcing of the capacitor, added weight, etc.), I thought about an old TVI-prevention scheme that used a tuned stub to trap out the offending signal. Then the idea came to light. Since a quarter-wave section of feedline that has been shorted at one end and is open at the other exhibits an infinite impedance at the open end—perfect for a trap—why not use quarter-wave stubs for traps? Some further thought provided the final solution: Make the 75-meter leg of an inverted vee part of a quarter-wave stub for 30-meter operation.

Fig 1. shows the mechanical layout. At my station, I use separate 40- and 75-meter antennas fed from a single 52-Ohm coax feedline. The 40-meter antenna is broadside to the north, allowing me to keep schedules with my dad (W0IMZ) while the 75-meter inverted vee is used for contacts east and west of my QTH. The object was to end up with two antennas that could operate on 75, 40, 30, and 12 meters using one 52-Ohm feedline.

Construction of the antenna was surprisingly simple, as was the adjustment. First the 75- and 40-meter inverted-vee antenna elements were erected using #14 copper wire obtained from the local hardware store. The antennas were then resonated at the frequency of interest on each band. The 75-meter antenna was to carry the 30-meter stub, and the 40-meter antenna the 12-meter quarter-wave stub. Since the construction of both antennas uses the same principles, this discussion will cover 75/30-meter elements.

From the feedpoint on the 75-meter leg, measure out a quarter wave using the *Radio Amateur Handbook* equation L(feet) = 234/f (MHz). For 30 meters this is L = 234/10.115, or 23.1 feet. Therefore, from the feedpoint, measure out 23.1 feet. This is the point at which the open end of the 30-meter stub begins. You may want to wrap a piece of masking tape on the 75-meter leg to mark the spot for future reference. From this spot, lay out the 23.1-foot wire beneath the top wire. At the end of the quarter-wave stub, it will be necessary to short the wire to the top 75-meter section. I used alligator clips so I could tune the stub before I soldered the connection. To complete the stub, you must use spacers for the wires. Radio Shack has

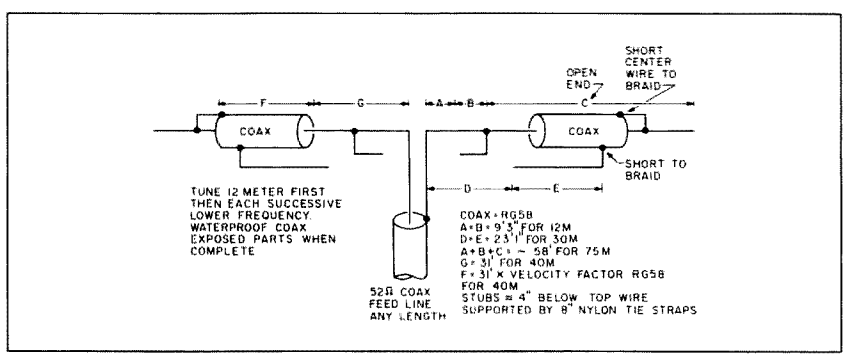


Fig. 2. Single-wire antenna for 75, 40, 30, and 12 meters (untried, but it should work).

6-inch nylon cable ties that work well for spacers. Simply loop them around the two wires and pull the tie to the first notch, locking it. This results in approximately a 3-inch spacing. The wire size and spacing result in approximately a 600-Ohm quarter-wave stub. Wooden dowel spacers could also be used.

An alternative to the construction as discussed above would be to use 300-Ohm twinlead or commercial open-wire twinlead. Simply use one leg as the top element of the 75-meter antenna. An advantage of twinlead is that it can be cut to approximately one-quarter wavelength, shorted at one end, and resonated using a grid-dip meter while on the ground. Then one side of the wire can be used as the top-wire element for the 75-meter antenna.

Once the mechanical details have been worked out, final-tune the 30-meter stub—either by moving the alligator clip toward the feedpoint an inch or two at a time if the resonant frequency is too low, or by moving the shorting alligator clip to the far end if the resonant frequency is too high. A final check of the 75-meter band will now be necessary because of the effects of the lower wire. Once the antenna is resonated, you may want to solder the end of the stubs to the top section to complete the job. You are now ready for some fun operating.

"I thought about an old TVI-prevention scheme that used a tuned stub to trap out the offending signal."

Operation of this antenna has met the expectations set for it. Tuning the 75-meter band from the low-frequency point to the high-frequency point provided a vswr of 2:1 or better over 4.4% of the band, which was almost the same when the 75-meter inverted vee was used alone. The 30-meter operation covered the entire 30-meter band with less than a 2:1 vswr. It measured about 2.2% of the resonant frequency. These percentages seem to agree with the expectations derived from the *QST* article.

This antenna offers some advantages over coil/capacitor trapped antennas. It eliminates the need for high-voltage capacitors. It also can handle the full, legal power limit, is easy to construct, and provides wide bandwidths on each band. There are several other methods that should prove satisfactory whereby quarter-wave traps could be constructed. Although I've not tried it, a single, full-size wire antenna could be made for 75, 40, 30, and 12 meters using a combination of coax quarter-wave stubs and open-wire quarter-wave stubs (see Fig. 2). I would like to hear from others who may try these ideas. 73 and good operating over more of our bands. ■

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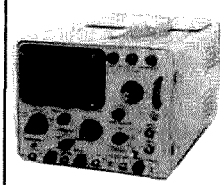
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Trap An Amazon Aerial

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A trap-tuned dipole can make a very satisfactory multiband antenna, but building it can be a real headache! My first attempt to build a trapped antenna, in 1970, resulted in dismal failure (which explains my formerly held low opinion of them). I must have learned something since then, for I now have several trap-tuned dipole antennas giving excellent service in a commercial radio communications net that I help maintain.

Perhaps among the readers of this magazine there is someone else who has been frustrated in an attempt to use traps in an antenna. If so, you may benefit from a discussion of the design procedure I followed.

I needed several antennas for use with 20-Watt transceivers operating on 6.954 MHz and 5.710 MHz. These made up portable stations carried by research teams working in the Amazon jungle. Our licenses limited us to dipole antennas, but for portability I didn't want to send two antennas with each station. In addition, since the antennas would be carried as baggage and would be erected by untrained personnel, I didn't want them to be either heavy or complicated. What resulted was a relatively lightweight, rugged dipole antenna that gives less than a 2:1 vswr at both frequencies.

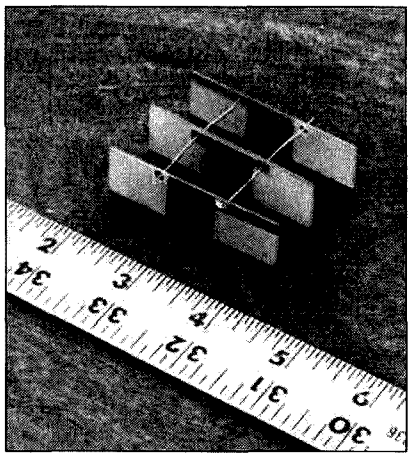


Photo A. Capacitor assembly strung on jumper wires; ready to be glued together.

The Trap-Tuned Dipole

A trap-tuned dipole for two frequencies is shown in Fig. 1. The inner antenna is cut for the higher operating frequency. Traps that are parallel-resonant at the higher operating frequency separate the inner antenna from extensions. The high impedance shown by the traps isolates the inner antenna from the extensions when the higher frequency is being used. Below resonance, the traps appear to be inductors connecting the extensions so that the overall antenna is active at the lower operating frequency.

Inductors and capacitors are reactive elements. That is, they react to alternating current to show a frequency-dependent opposition to current flow. The Ohmic values of inductive and capacitive reactances are calculated using Equations 1 and 2, respectively. These reactances are, you might say, of opposite characteristics, though both are measured in Ohms.

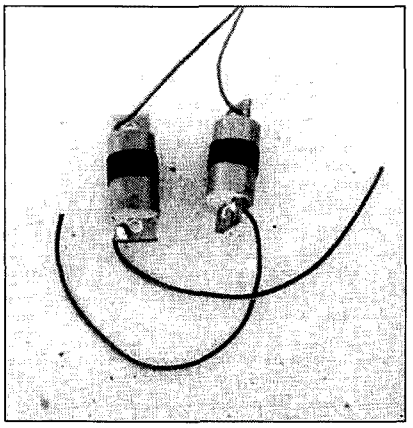


Photo B. Completed traps.

For a complete treatment of these reactances, phasor algebra is employed. I won't go into that. Suffice it to say that strange things happen in circuits containing both inductive and capacitive reactances.

Equation 1: $X_L = 2\pi fL$

Equation 2: $X_C = 1/(2\pi fC)$

where L is the inductance in Henrys, C is the capacitance in Farads, f is the frequency of operation in Hz, and X_L and X_C are in Ohms.

As you can see from these equations, inductive reactance increases and capacitive reactance decreases as frequency increases. A circuit containing an inductor and a capacitor will have both inductive reactance and capacitive reactance. At some frequency, those reactances are equal and cancel, resulting in the phenomenon called "resonance." When the reactances are in series, this cancellation results in a low impedance. When the reactances are in parallel, the result is a very high impedance, which is the characteristic that makes a trap-tuned antenna possible.

Equation 3, giving the relationship between L, C, and resonant frequency, shows that virtually any inductor can be made to resonate at any frequency by selecting the proper capacitor.

Equation 3: $f_r = 1/(2\pi\sqrt{LC})$

where L is inductance in Henrys, C is capacitance in Farads, and f_r is the resonant frequency in Hz.

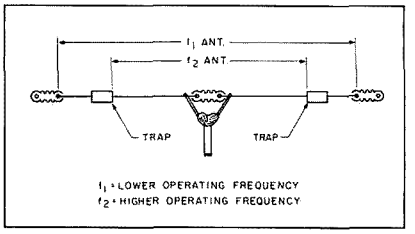


Fig. 1. Trap-tuned dipole antenna.

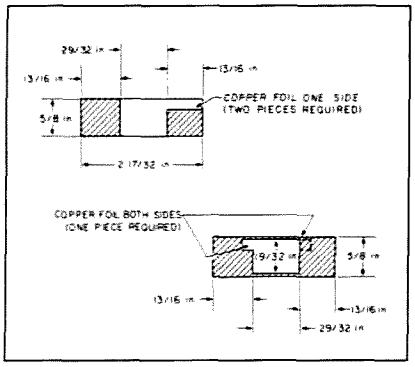


Fig. 2. Plates for 50-pF capacitor assembly.

F (MHz)	C (pF)	L (uH)	L/C
6.954	50	10.5	210,000
7.200	47	10.4	221,277
14.300	24	5.16	215,000
21.300	16	3.5	218,750
28.200	12	2.65	220,833

Table 1.

This indicates that traps can be built using a wide range of values, but there are some practical considerations. The relationship of L and C to the resonant impedance of the trap is shown in Equation 4.

Equation 4: $Z_t = L/(CR)$

where L is inductance in Henrys, C is capacitance in Farads, R is the resistance of the inductor in Ohms, and Z_t is the resonant impedance in Ohms.

As L is increased and C is decreased, Z_t increases. A high L/C ratio would seem to be best in order to ensure that the trap will show a high impedance at resonance. However, the physical size of a large-value inductor imposes some limitation, as does the difficulty of using extremely small values of capacitance. It is necessary to strike a compromise.

At the frequency I used, 6.954 MHz, I found that a 10-uH inductor and a 50-pF capacitor give good results. Their impedances are about 460 Ohms and their L/C ratio is around 200,000. From Equation 4 we find that the parallel-resonant impedance of these components will be over 200k, even if the dc

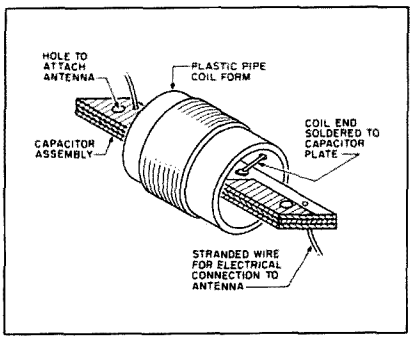


Fig. 4. Trap assembly.

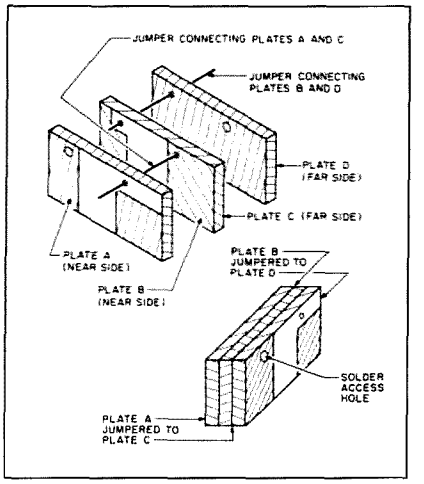


Fig. 3. Capacitor assembly detail.

resistance of the inductor is as high as 1 Ohm. It is reasonable to expect less than 1 Ohm of resistance in the coil, so these were the component values I selected.

I calculated the capacitances required at various frequencies for an impedance approximately equal to the impedance presented by the 50-pF capacitor at 6.954 MHz. I then used Equation 5 to calculate the inductances required to resonate the capacitors at those frequencies, and verified that the L/C ratio was at least 200,000.

Equation 5: $L = 1/(4\pi^2 f^2 C)$

where f is the desired resonant frequency in Hz, C is the capacitance in Farads, and L is the inductance in Henrys.

Table 1 gives the component values used and shows the L/C ratios.

The Capacitors

I decided to deal first with the capacitors, since inductors are relatively easy to adjust to a desired value. I experimented with both molded mica and dipped silver-mica capacitors. (Admittedly, this was possible only because I was working with low power. For higher power, special transmitting capacitors are needed.) The silver-mica type produced good results, but I didn't have enough of them to make all the antennas I needed. Being somewhat reluctant to spend money needlessly, I decided to try building

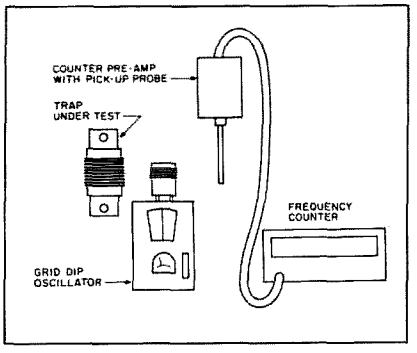


Fig. 5. Test setup.

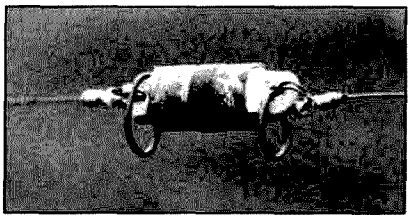


Photo C. Trap installed in antenna.

my own capacitors. Why buy when you can build?

Double-clad, glass-epoxy printed-circuit-board stock seemed a good choice of material since I had some on hand, but before becoming too deeply committed to this project I wanted to determine the feasibility of using this material for these capacitors. I didn't want to build a capacitor that would make the traps so large that the antenna would not fit the shipping container!

Capacitance is relatively easy to relate to size, but the equations invariably call for the dielectric constant. Since this figure was not available to me, I determined it by measuring the capacitance of one square inch of the board material and comparing it with the calculated capacitance of an air-dielectric capacitor of the same dimensions. (I used a capacitance meter built following plans in an amateur magazine, so this isn't really an exotic piece of equipment.)

The measured capacitance was 30 pF/square inch. The capacitance with air dielectric was calculated to be about 5.1 pF, using Equation 6.

Equation 6: $C = 0.2249 \times (kA/d) \times (n - 1)$

where C is capacitance in pF, A is the area of one plate in square inches, d is the distance



Photo D. Feedline protection using the PY8ZAC/W8VOH method.

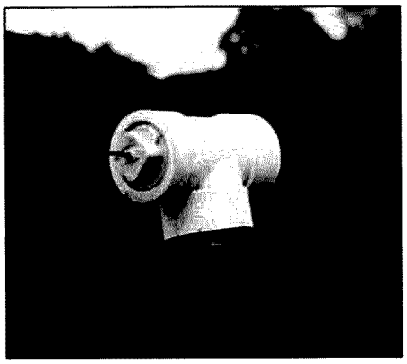


Photo E. Feedline protection using plastic pipe fitting.

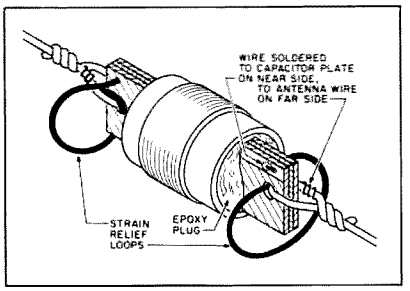


Fig. 6. Connecting the trap to an antenna.

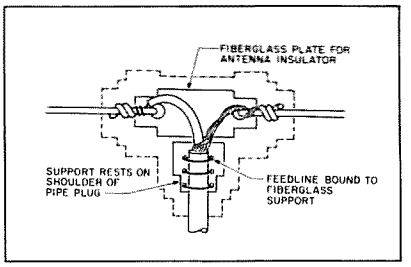


Fig. 7. Interior view of the plastic pipe fitting showing antenna feedpoint assembly.

separating the plates in inches, n is the number of plates in the capacitor, and k is the dielectric constant of the insulating material (30 pF/5.1 pF = 5.9).

Using Equation 6, with k = 5.9, I found that the required plate area for a two-plate, 50-pF capacitor is approximately 1.6 square inches. That was a bit larger than I wanted. One more pass through the equation showed that a 4-plate, 50-pF capacitor required a plate area of only 0.56 square inches, which seemed much more reasonable for my application. The calculated dimensions and number of plates for the capacitors are shown in Table 2.

I built the 50-pF capacitors using plates measuring 5/8" x 29/32", prepared by cutting the copper foil on three pieces of board material as shown in Fig. 2. The copper on one side of two of those pieces was cut so as to center the plate area and leave a finger extending to one end of the piece, while the copper was removed from the other side. A single piece was prepared with a plate on both sides, each with a finger extending 3/16" toward an end, such that they could be assembled as shown in Fig. 3.

The copper foil of each single-sided piece is on the outside and the double-sided piece is in the middle. The fingers on the outer pieces, plates A and D, point toward opposite ends. The fingers on plates B and C are oriented the same as the fingers on plates D and A, respectively. I used epoxy to glue all the pieces together.

Access holes drilled for this purpose allowed jumpers to be soldered to connect the fingers on the inner piece with the corresponding fingers of the outer plates to form a 4-plate capacitor. I then trimmed the capacitor to measure precisely 50 pF by cutting thin strips of copper from the exposed plates. The glass-epoxy board pieces are long enough to extend beyond the area used for the capacitor so that they can be used to attach the antenna. The same procedure was used for the other capacitors, using the dimensions given in Table 2.

The Inductors

As shown in Fig. 4, I glued each rectangular capacitor into a piece of 5/8" plastic pipe, which also served as a form for the trap's inductor. Table 3 lists the inductors required to resonate the capacitors previously chosen for use at the selected frequencies. To calculate the approximate number of turns of wire required for each, I divided the inductance per inch of the proposed coil into the desired inductance and multiplied the quotient by the turns per inch. The inductance per inch may be found from Equation 7.

Equation 7: $L = (nr)^2/(9r + 10l)$

where L is inductance in uH, l is the length of the coil in inches, r is the mean radius of the coil in inches, and n is the number of turns in the coil.

For my low-power use, I felt safe using a close-wound coil, so n was based on the turns-per-inch specification from the wire tables. From Equation 7, I found that #26 wire close-wound (58 turns per inch), 1 inch long on a 13/16" form (the outside diameter of 5/8" plastic pipe) will have approximately 39 uH of inductance. Dividing the desired inductance, 10.5 uH, by 30 uH and multiplying by 58 turns per inch indicated that 16 turns would be required (see Table 3).

I then checked my figures by calculating the inductance of 16 turns of #26 wire close-wound on a 13/16" form and found it was only 6.5 uH! Apparently the relationship is not linear. By this kind of repetitive calculation, I determined that 22 turns will produce approximately 10.5 uH.

With the capacitor assembly glued in place inside the coil form, I wound the calculated turns of wire plus about 10% onto the plastic pipe and soldered the ends to the capacitor. Using the test setup shown in Fig. 5, I measured the resonant frequency of the trap. As expected, it resonated at a lower frequency than I wanted, so I removed wire a bit at a time until the trap resonated at the desired frequency. The exact number of turns required varied slightly depending on the actual value of the capacitor, so I was careful always to start with extra turns in the coil. Generally, I have more success shortening a wire than I do lengthening it!

The Antenna

When the traps were built, I sealed the ends of the coil forms using epoxy putty and coated the entire assembly with regular epoxy to secure and protect the coil. Wires soldered to the fingers of copper foil on the capacitor pieces are used to connect the traps to the antenna.

The antenna was built following the pattern of Fig. 1. The inner antenna was cut for the higher frequency, f2, according to the length calculated using Equation 8.

Equation 8: $l = 468/f$

where l is the antenna length in feet and f is the operating frequency in MHz.

For 6.954 MHz, the inner antenna was 67' 4" long. At that frequency, the traps are intended to serve as insulators. Returning to Equation 4, we can calculate the theoretical impedance of these traps at resonance to get an idea of their effectiveness for this purpose.

The 10-uH inductor required 4.25 feet of #26 wire, which has about a 0.04-Ohm resistance per foot, so R will be 4.25 x 0.04 Ohms, or 0.17 Ohms.

Applying Equation 4, we find:

$$Z_t = L/(CR)$$
$$= 10.5 \times 10^{-6}/(50 \times 10^{-12} \times 0.17)$$
$$= 1.24 \times 10^6 \text{ Ohms}$$

That is 1.24 megohms, which should isolate the inner antenna adequately at the higher frequency. This impedance could be increased by using larger wire for the inductor so as to have a lower value of resistance in the coil.

At 5.710 MHz, the traps exhibit 560 Ohms of capacitive reactance and only 370 Ohms of inductive reactance, so the antenna current will flow mostly through the inductor. This inductance will tend to electrically lengthen the antenna, so its physical length will be somewhat shorter than its theoretical length. It probably would be possible to calculate this, but I just used the theoretical length of antenna for the lower frequency and trimmed the length until the vswr was acceptably low. When the total antenna length was 75' 5", the vswr at 5.710 MHz was approximately 1.8:1 and at 6.954 MHz was 1.5:1. As the theoretical length of antenna for 5.710 MHz is 81' 11.5", this means the traps reduced the low-frequency antenna to about 92% of its theoretical length.

The characteristics of these traps are predictable and the results are repeatable. Being the pessimistic type, I built each antenna a bit long at first and trimmed it. However, as I gained confidence, I began cutting them to

C (pF)	Plate Area (sq. in.) 2-plate	4-plate	Capacitor Used (see text)
50	1.6	0.56	4 plates, 5/8" x 29/32"
47	1.5	0.52	4 plates, 5/8" x 27/32"
24	0.78	0.27	4 plates, 1/2" x 9/16"
16	0.52	0.18	2 plates, 5/8" x 27/32"
12	0.39	0.13	2 plates, 9/16" x 23/32"

Table 2.

L (uH)	Coil on 3/16" Form
10.5	22 turns #26, close-wound
10.4	21-3/4 turns #26, close-wound
5.16	13-3/4 turns #26, close-wound
3.5	11 turns #26, close-wound
2.65	9-1/4 turns #26, close-wound

Table 3.

the same measurements as the prototype without allowing extra for trimming. All of these measured less than a 2:1 vswr at both operating frequencies.

Ensuring Durability

Since these traps were used as the mechanical support of the antenna, I was concerned that they might not be strong enough to withstand the pull. As a crude test, I tied one about 10 feet up on an antenna tower and stood in a loop of wire attached to it. It supported my weight (190 lbs.), so I concluded that the antenna wire would break before the traps would.

One weak point in this antenna is the connection of the traps to the antenna wires. Since the antenna sways in the wind and is taken down periodically, the trap connections are subject to flexing. I have had good success in reducing the effects of that flexing by making the connections using a strain-relief loop, as shown in Fig. 6. In the event that a connecting wire does break, another wire can easily be soldered to the finger of the capacitor plate without disturbing the epoxy plug in the end of the coil form.

Another weak point on any wire dipole antenna is the fact that the feedline is open at the top. If water enters the feedline, it will cause the line to deteriorate, and may even run out at the bottom end making a puddle where you least expect it!

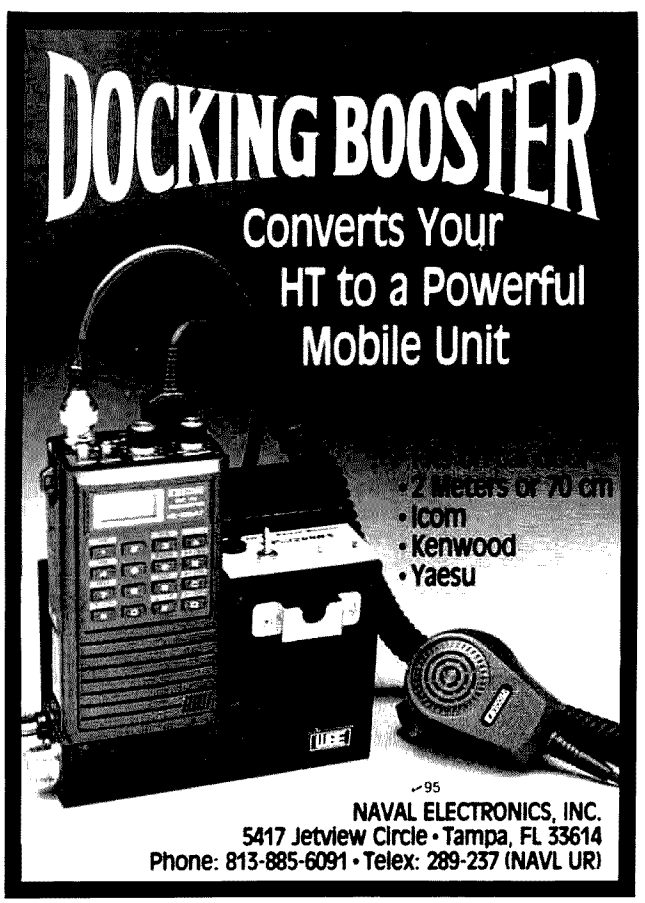
Photo D shows one solution to this problem—as described in *73* almost 10 years ago by PY8ZAC/W8VOH. The loop in the coaxial cable keeps the open end pointing down so rain will drain away from it. Sealing the open end with epoxy or a *noncorrosive* silicone rubber will provide additional protection. (Note that the silicone rubber preparations that smell like vinegar will cause corrosion.)

Photo E shows a more elegant way to weatherproof the center feedpoint. A plastic pipe T connector encloses the antenna feedpoint assembly (Fig. 7). The holes in the three pipe plugs, through which the wires and feedline pass, are sealed by means of epoxy or noncorrosive silicone rubber.

Conclusion

I have found the performance of these antennas to equal that of regular dipoles while occupying less space and weighing less. In addition, they cost less. The epoxy seal has held up well even with the rains we experience in the tropics. The only antenna I have had to repair, of the ten I have in use, is the one that broke when a strong wind caused the supporting tree to sway more than we expected. The antenna wire broke, rather than the trap, so this confirmed the results of my crude weight-bearing test.

It's a pity I "grow too late smart"! These antennas could have saved me lots of work over these past years! ■





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Resonant Wire Antennas

You may not believe it, but you can build a working antenna without the crutch of coax!

More often than not, homemade antennas perform better than store-bought ones. This is because most commercially-manufactured systems are designed primarily so that they can be fed with coaxial cable. Performance is only a secondary consideration.

Coaxial cable is neat stuff and is convenient to use. But, it's expensive, and, although a few amateurs think that *all* antennas are fed with coaxial cable, it's the worst kind of feedline to use if the antenna is to work effectively on several amateur bands.

How would you like to have an antenna that works well on several bands and one that has *no* feedline loss? Impossible, you say? Not at all. You can build an antenna that has no feedline, and therefore no feedline losses. Simply use the following principles in your design:

1. A half-wave resonant antenna (dipole) has high rf *voltage* at its ends and high rf *current* at its center (see Fig. 1).

2. The length in feet of a half-wave resonant antenna is 468 divided by the frequency in megahertz (L = 468/f).

3. An antenna that is a half wavelength long for a low band (such as 3.5 MHz) is also resonant at harmonics of the lower bands and has high rf voltage at its ends. Harmonics of 3.5 MHz are 7, 14, 21, and 28 MHz (see "Harmonics" sidebar).

4. In tuning a coil and capacitor to resonance at a given frequency, parallel tuning is used to provide *rf voltage*, which is needed to feed the end of a resonant-length antenna.

5. Link coupling can be used to take rf from the transmitter into a parallel-tuned inductor, one end of which is connected to the end of a resonant-length antenna. The other end of the parallel-tuned coil is connected to the grounding system (see Fig. 2). The rf energy, in the form of voltage, goes into the antenna wire and is radiated.

As with other types of antennas, the parts of the antenna that have the greatest amounts of rf current in them should be as high and in the clear as is possible. Supporting a wire vertically would put the rf current part of the antenna as high as possible (see Fig. 3). Half-wavelength vertical antennas work well and are practical on the higher bands. They provide the low-angle radiation needed for working DX.

Antennas do not have to be supported in a straight line. Inverted vee, inverted L, or other configurations can be used. W8BVU once had an antenna the top of which was taped to a bamboo fishing pole. The wire had several curves going from the antenna tuner up to the bamboo pole. W8BVU called it the Chinese Snake Antenna.

For protection against lightning damage, a means of grounding the antenna when it is not in use should be provided outside of the building (see Fig. 4). Note the SPDT switch and the separate earth ground used for this lightning protection.

Two circuits for an antenna tuner to provide rf voltage to feed an endfed resonant-length wire are shown in Fig. 5. The variable capacitor in series with the primary coil (L_1) is helpful in reducing the swr between the transmitter and the antenna tuner. Plug-in coils can be wound on plug-in coil forms or

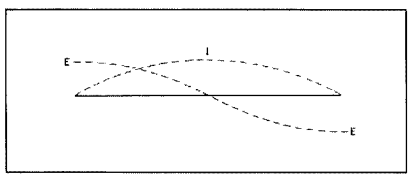


Fig. 1. Rf voltage and current distribution on a half-wave resonant antenna.

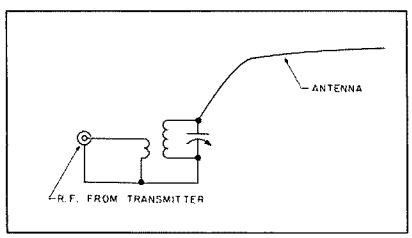


Fig. 2. Feeding rf voltage *to the end of a resonant antenna (parallel-tuned coil to give rf voltage).*

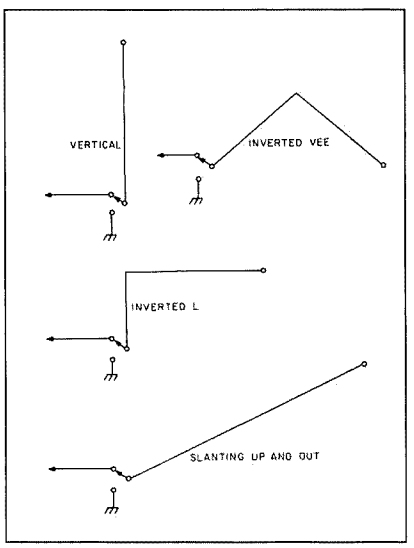


Fig. 3. Some endfed-antenna configurations.

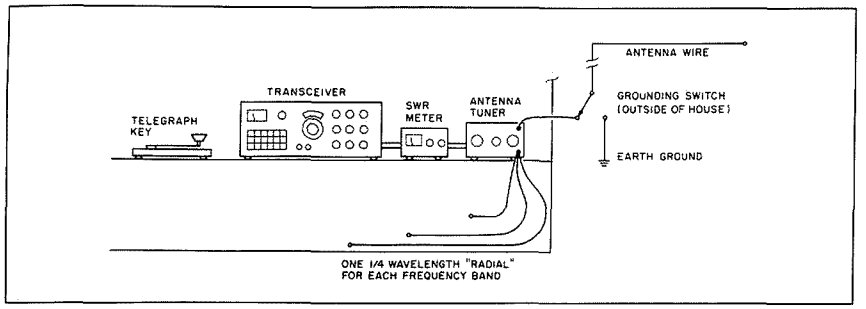


Fig. 4. Protect your station against lightning damage with a grounding switch mounted outside of the house.

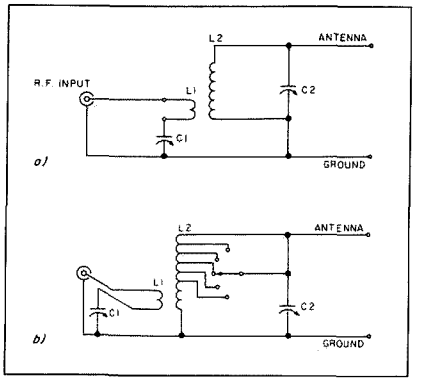


Fig. 5. Circuits of simple tuners suitable for feeding rf voltage to one end of a resonant-length antenna wire. The tuner in a) utilizes plug-in coils, while the circuit shown in b) uses a more convenient tapped coil. (These tuners will not *work with a random-length antenna wire.)*

on the bases of burned-out tubes, sometimes made longer with cardboard tubing. It's not necessary to have a coil for each band. One coil would cover 1.8–4 MHz, another 7–10.15 MHz, a third 14–21.5 MHz, and the fourth 21–30 MHz. For best results, the parallel-tuned coil and capacitor combination should have a relatively large inductance tuned to resonance by a relatively small capacitance. (See the sidebar on coils and capacitors.)

Those of us who have an antenna tuner with a single-wire terminal can easily try out an antenna that does not have a feedline. We can string up a random, but reasonable, length of wire as high as possible, bring one end into the shack, connect it to the single-wire terminal of the antenna tuner, load it up, and go on the air.

A good grounding system (sometimes called a "counterpoise") connected to the ground post of the antenna tuner is a *must* when you're using any endfed antenna. Such a grounding system can be made by connecting quarter-wavelength wires to the antenna tuner's ground post (one wire for each band on which the antenna is to be used). Table 1 gives quarter wavelengths of commonly used bands. The far ends of these wires should be taped with electrician's tape because they might be hot with rf when the rig is transmitting.

These wires can be located inside the house, running along the baseboards of rooms (for example), or they can be run outside of the house near the ground. These radials help prevent rf-in-the-shack problems and equipment hot with rf. (William I. Orr W6SAI and Stuart D. Cowan W2LX, in their book, *Simple Low-cost Wire Antennas*, have an excellent chapter on endfed antennas: Chapter 8, "The End-Fed, Multi-Band Antenna." This chapter emphasizes the importance of ground radials and describes a simple L-net antenna tuner for use with endfed antennas. This book is one of the best in my antenna library.)

1.8 MHz	120 to 130 feet
3.5 MHz	63 to 66 feet
7 MHz	32-1/2 to 33 feet
10 MHz	21 to 22-1/2 feet
14 MHz	16 to 17 feet
21 MHz	11 to 12 feet
28 MHz	8 to 8-1/2 feet

Table 1. Quarter wavelengths for each band.

An important characteristic of endfed antennas is that they can be used on several bands. Such antennas should be at least a quarter wavelength long for the lowest band on which they will be used. For example, an antenna for the 3.5–4-MHz band and higher bands should run at least 65 feet, and 90 to 100 feet would be even better.

A good length for bands 14 MHz and higher would be 45 to 50 feet. Such an antenna would work also on the 7- and 10.1-MHz bands. For gain in the direction of the wire on the 14-MHz and higher bands, the endfed antenna should be several hundred feet long—the longer the better.

Loading the Endfed

The output of the transmitter (transceiver) goes through the swr meter into the antenna tuner's input. The endfed antenna is connected to the single-wire terminal of the antenna tuner (see Fig. 4). Using low rf power from the transmitter, carefully adjust the inductance and variable capacitance of the antenna tuner for the greatest amount of forward power with the least amount of reflected power. (Follow the directions that came with the tuner.) It will be possible to find settings on the tuner that will result in much forward power with little or no reflected power.

After you've made these adjustments using low power, the rf power output of the trans-

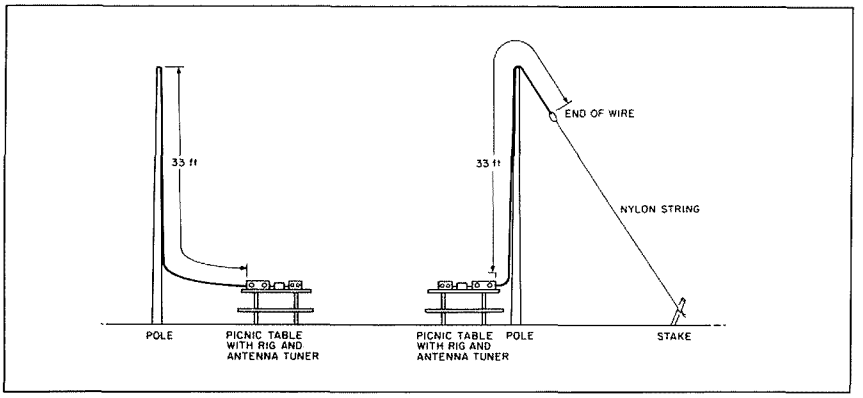
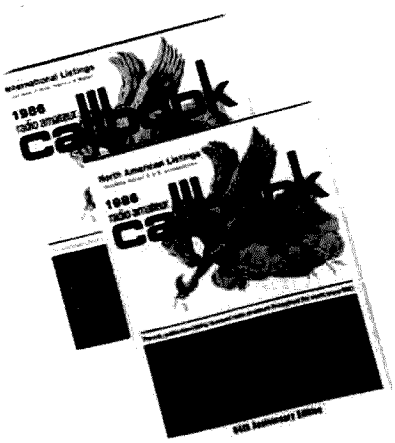


Fig. 6. Twenty-meter vertical resonant-wire antennas.

HARMONICS

Harmonic frequencies of an antenna of a given length are not exact multiples of the fundamental frequency. They are higher than the fundamental frequency multiplied by the number of the harmonic. For example, the second harmonic of an antenna length that is a half wavelength long at a frequency of 3510 kHz is greater than 7020 kHz. This is because there is less "end effect" on the harmonic frequencies. (See the 14th edition of the ARRL *Antenna Book*, p. 2-7, "Length of a Harmonic Wire.") Therefore, it is a good idea to make a resonant endfed antenna the correct length for a frequency near the low end of the lowest band on which the antenna is to be used. This is so that its harmonic frequencies will not be too high. The antenna tuner provides some adjustments for the higher frequencies of the lowest band to be used, and on the harmonic bands of the antenna.

1986 CALLBOOKS



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mitter should be increased to the desired level and the dial settings of the variable capacitors touched up a bit to get rid of any reflected power that may be present. *With rigs that have tube output stages, the "plate-tune" control should be checked and the plate current "dipped" to the lowest amount.* The rig will then be ready to go on the air and make contacts.

On the Road

Endfed antennas are especially good for portable use. Amateurs who like to take their radio equipment with them on camping trips can use endfed antennas to good advantage. For example, at a weekend camp-out in a northern Michigan trailer camp, W8BVU put his receiver, transmitter, and antenna tuner on a picnic table. Using an endfed 33-foot antenna wire supported vertically by some light lumber and a long fishing pole, he had his usual Saturday-morning schedule with W7WV in Scottsdale, Arizona. In June, 1985, I set up a QRP station in a cabin in Colorado. With a 67-foot endfed antenna and 6 Watts of rf, I joined my regular Tuesday-evening net and worked stations in St. Louis, Missouri; Dickinson, Texas; and Silver City, New Mexico.

It's fun to take a small battery-operated transceiver on picnics; an endfed antenna is ideal for this activity. It's not difficult to hold up a 20-meter vertical antenna (33 feet) if a telescoping 20-foot fiberglass fishing pole is available. The pole can be mounted on top of other lightweight bits of lumber, and excess length can be accommodated by mounting the pole some distance from the table and running the wire horizontally for the necessary distance. Excess wire also can be attached to a piece of nylon string and run out and down from the top of the pole—fasten the string to a stake driven into the ground (see Fig. 6).

For the lower bands, the light wood and fishing pole combination could be used to hold up the center of a longer endfed wire in the form of an inverted vee.

It would be fun to use as an endfed antenna a piece of fine wire suspended vertically from the string of a high-flying kite. Marconi communicated across the Atlantic Ocean with a kite-supported antenna. Perhaps you could, too!

If you have never done so, you owe it to yourself to try an antenna that has no feedline losses. Get the high rf part (or parts) of the antenna way up in the air and enjoy the good QSOs that it will provide on two or more bands. It might be the best antenna that you ever had. ■

ENDFED ANTENNA TUNER COIL AND VARIABLE CAPACITOR INFORMATION

(Resonant-Length Wires Only)

C_1 is a two- or three-gang broadcast band variable capacitor with all of its stator sections connected in parallel.

C_2 is a variable capacitor with wide enough spacing between its plates to withstand the rf voltage that will be applied to it without arcing. Its value should be at least 100 pF. A vernier dial on this capacitor helps in making fine adjustments.

Plug-in coil data:

Frequency Range	L_1 Turns	L_2 Turns	Diameter of Coil Form
1.8 to 4 MHz	5	35	1-1/2 inches
7 to 10.15 MHz	3	10	1-1/2 inches
14 to 21.5 MHz	2	5	1-1/2 inches
21 to 30 MHz	2	4	1 to 1-1/4 inches

The 1.8-to-4-MHz coil is wound with #22 wire, either DSC or enameled. Heavier insulated wire such as #18, #16, or even larger can be used on the other coils. L_1 is made of #14 insulated house-wiring wire and is close-wound over the ground end of L_2. If plug-in coil forms are not available, the bases of burned-out tubes can be used and made longer by means of cardboard or plastic tubing. The inductance of L_2 can be made smaller by spreading apart the turns of the coil. Squeezing the turns together increases the inductance of the coil.

L_2 connected in parallel with C_2 *must* tune to resonance at the frequency being used. This can be checked with a grid-dip meter. If none is available, one side of a neon bulb can be connected to the antenna post of the tuner. When rf from the transmitter is going into the tuner, the neon tube will glow when resonance at the frequency being used is attained by adjusting C_2. (Before the days of swr meters, "neon-tube tuning" was used to indicate rf voltage for endfeeding resonant-length antennas.) The diameter of the coil form can be different from those shown. If the diameter is greater, fewer turns on L_2 are needed. If the diameter is less, perhaps a turn or so more may be needed. The main consideration is that C_2 and L_2 must be of such values that they will tune to resonance at the frequency being used.

For the tapped coil, the coil form can be a piece of wooden dowel 1 to 1-1/2 inches in diameter that has been boiled in paraffin. Plastic, ceramic, or cardboard coil forms can also be used. The secondary (L_2) should have 35 turns tapped at 3, 5, 7, 9, 11, 13, 18, 25, 30, and 35 turns. If there are more positions on the switch, there could be more taps on the coil. The primary (L_1) should be close-wound over the ground end of L_2. Insulated wire #22 or larger should be used in winding L_2. Number 14 insulated house-wiring wire can be used for L_1.

Bob Eldridge VE7BS
Erickson Road
Pemberton BC
Canada V0N 2L0

The Lazy U Dipole

VE7BS's Lazy Z takes on a new bent.

Several years ago I described a sort of "Lazy Z" antenna in use on 160 meters. Pat Hawker G3VA commented on it in *Radio Communications*, a reader tried it on 40 meters and reported promising results, and Bill Orr mentioned it in his column in *Ham Radio*. Somewhere along the line it had become the "VE7BS Antenna," but by this time I had come to the conclusion that the "Lazy U" (described below) worked rather better.

The VE7BS was basically a half-wave dipole bent in the right places (see Fig. 1). The arrows show the direction of current flow at a given moment, and you can see that the two end sections are in phase with each other. Most of the radiation is from the center section where the current is higher, so the contribution of the end sections is not that great, and they are too close to each other to give any broadside gain. But this configuration does make it possible to have the main radiating portion at a relatively steep angle while preserving the useful bandwidth of a full-length dipole.

A straight sloping half-wave dipole 240 feet long suspended from a 100-foot-high support thinks of itself as a horizontal dipole 50 feet high and fires mostly straight up on 160. A bit of geometry or a scale drawing shows why—even if the wire were tight and straight, it would be only 24 degrees from the horizontal.

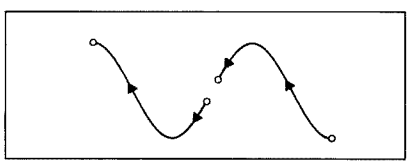


Fig. 1.

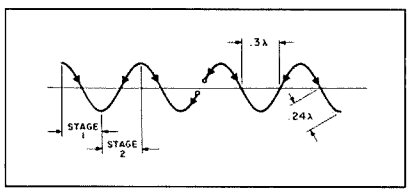


Fig. 2.

All this came to mind when W4KM brought to my attention an interesting item that appeared in *Radio* (published in the USSR), describing the "snake antenna" used by UY5AP for communication via satellites on 144 MHz (see Fig. 2). UY5AP's antenna is made with rigid coaxial cable, using the sheath as a fat conductor (3/8" or 1/2" copper pipe would be an ideal material to use for this kind of construction). It is described as a "seven-stage synphase" antenna, with a figure-8 pattern in the horizontal plane and a narrow lobe toward the horizon in the vertical plane. Bear in mind that this is on 144 MHz, so presumably the antenna is mounted several wavelengths above ground.

The dimensions given in *Radio* show that each stage is a half wave long, slightly shortened to allow for the diameter/length ratio, and the distance between each stage is a 5/16 wave.

In effect, then, we have seven close-spaced elements in phase as far as vertical polarization is concerned, but each stage is in antiphase to its neighbor as far as horizontal polarization is concerned. I came to this conclusion by playing with current-flow arrows, as illustrated in Fig. 3.

You can look upon it also as a pair of cross-polarized stacks with four elements copolarized and three others in quadrature with them. Maybe, with four in one direction and three in the other, this could be said to be elliptical? (See Fig. 4.)

This is all very interesting for the 2-meter satellite enthusiast, but for me VHF is an abstraction. To erect such an antenna for an HF band requires a rather long line of trees, but it doesn't *have* to be seven stages long, does it! After all, not all yagis have 60-foot booms, but there are lots of yagis around.

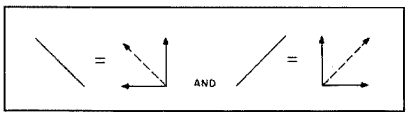


Fig. 3.

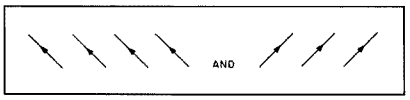


Fig. 4.

How about three stages? With a basically vertically polarized array it can be close to the ground without suffering ill effects, and for 40 meters a three-stage "snake" would be about 150 feet long and could be hung on supports 50 feet high. It would need only two such supports, because one end of the snake is close to the ground (see Fig. 5).

There are definite advantages to having an antenna that has cross-polarized elements. All signals coming via the ionosphere rotate on the way, and the degree of rotation is unpredictable. It is because of this rotation that you can get good signals (most of the time) on your horizontal antenna although the other fellow is using a vertical. But some of the QSB you suffer comes from the rotation of the signal, and if your antenna can respond to any polarization, you suffer less. I don't recall seeing anything about this antenna arrangement in the literature, although it seems impossible that Kraus and Sterba and Franklin and company could have overlooked it in the heyday of linear arrays for HF in the thirties.

The seven-stage VHF snake has a feedpoint impedance of 300 Ohms, so it is fed

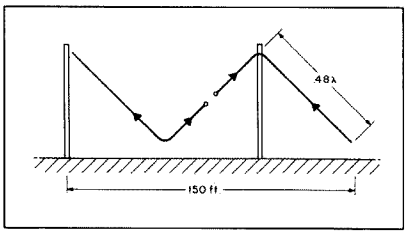


Fig. 5.

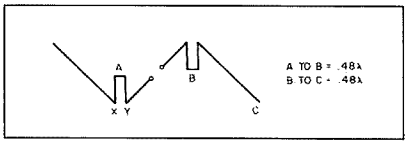


Fig. 6.

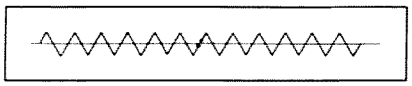


Fig. 7.

with 300-Ohm balanced feeder or with 75-Ohm coaxial cable through a 4:1 coaxial balun. In the three-stage HF version, the feedpoint impedance is between 100 and 125 Ohms. A quarter-wave section of 75-Ohm transmission line transforms nicely from 50-Ohm cable to the feedpoint impedance.

The wire is supported at the bends by insulators and a short piece of ABS tubing to keep the bend from being too sharp, so each "element" is 468/f long to allow for end effect. If available height or space is a bit short, there are some interesting possibilities in folding at the corners, as shown in Fig. 6. Points X and Y are at the same potential and sign, and so can be tied together without harming the resonance. But that's a complication.

A Japanese Snake

In 1984, a short item appeared in the IEEE literature[1] describing the results obtained from bending the wire of a dipole in zigzag fashion, but in this case at more frequent intervals than with the "synphase" just discussed. Starting with a length of wire a half wavelength long, it is bent as shown in Fig. 7 to make each zig or zag .0208 of a wavelength long (12 bends in each half of the dipole).

If the angle of each bend is made 130 degrees, the actual length of the antenna will be shortened by 10% and the antenna will be self-resonant with a feedpoint resistance of 65 Ohms and a negative reactance of about 50 Ohms. The patterns and the half-power bandwidth remain about the same as a straight half-wave dipole, and this stays true if the antenna is shortened further by decreasing the angle at each bend. What is more, the input resistance does not change radically.

For example, if you make the original wire .58 of a wavelength long and then compress it to .4 of a wavelength (20% shorter than a straight half wave), the input resistance is a little less than 50 Ohms, a direct match to RG-8 coax if you use a transmatch to compensate for any reactance that appears.

I suppose a stretched-out Slinky™ would work in a somewhat similar way, although the theory of the close-coiled Slinky is probably different. [*See "The Ramada Radiator" in this issue.—Ed.*] The possibilities of combining the shortening effect of the 24-bends-per-half-wave with the synphase effect of the one-bend-per-half-wave are endless. If you are interested, the basics of the shortening effect are covered in a 1982 IEEE publication[2].

The Lazy U

There are only two bends in the Lazy U variant of the half-wave dipole—see Fig. 8. You make the vertical portion as long as possible (some have been used on 160 meters with as little as 33 feet of vertical) and the top horizontal wire should be directly above (parallel to) the bottom wire. The bottom wire can

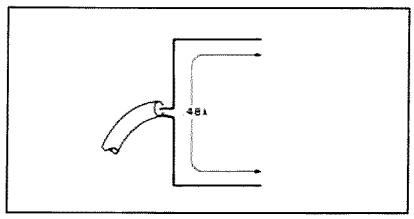


Fig. 8.

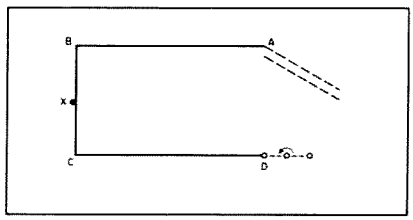


Fig. 9

be as close to the ground as practical convenience allows, but preferably at least six feet up; remember that there is a high rf potential at the end!

Radiation is effectively vertically polarized. Maximum current flows in the vertical portion, and experiments have shown that a displacement current flows between the upper wire and the lower (in effect, counterpoise) wire, creating a whole raft of phantom verticals.

It is much quieter than a vertical monopole on receive, and I have a special affection for it because it gave me my first African contact from VE7 on 160. (That particular antenna had about 90 feet of vertical, but one with 60 feet of vertical worked about the same.)

Bring the coax away horizontally for a few feet from either the side or the back of the U—a few turns of coax wound as a choke near the feedpoint will prevent antenna currents from running on the outside of the coax shield.

It is more or less a single-band antenna, but was derived from the multiband G8ON[3,4]—see Fig. 9. A to D is a half wavelength; on harmonic frequencies, X to D is an odd number of quarter wavelengths. X is the center of a half-wave section, the point of maximum current. AB and CD are equal, and AB is parallel to CD. CD is, in effect, a counterpoise, at least six feet above the ground. The dotted portion is a single-wire feeder—it could be open-wire zepp.

To use it on higher frequencies, you put suitable lengths of wire as extensions at D to create a current maximum at X (make the point X an odd number of quarter waves from the *far end*—point D).

A General Reminder

When you make a bend in a resonant antenna, make it as gradually as possible. A sharp corner tends to look something like a termination to the rf current arriving at it. Although the general idea is that you want the current to jump off some time in the direction of the other station, you also want it to recognize what frequency the antenna is designed for!

Have fun bending! ■

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1. H. Nakano et al, "Shortening Ratios of Modified Dipole Antennas," *IEEE Transactions on Antenna and Propagation*, Vol. AP-32, No. 4, April, 1984.
2. J. Rashed and C. T. Tai, "A New Class of Wire Antennas," *1982 IEEE Antennas and Propagation Society International Symposium Digest*, Vol. 2.
3. Pat Hawker G3VA, *Amateur Radio Techniques*.
4. VE7BS, "Wire Antennas," *The Canadian Amateur*, March and April, 1979.

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Carl H. Crumley N4VD
413 Turkey Hill Drive
King NC 27021

The 75m Laid-Back Quad

Unable to build a 75m helix, N4VD settles for four 70-foot pine trees.

When I removed the February, 1985, issue of *73* from my mailbox, I was excited to see a picture of Ollie W1ZB standing beside a 20-meter helix. You see, I have a fetish about adapting VHF-style antennas to HF use. Ollie hit an experimental nerve in me, and I immediately went out looking for something between the size of a water tower and the Astrodome around which I could wind a 75-meter helix.

It must come as no surprise to anyone that I have yet to find a suitable cylindrical object that will serve as a winding form for such a corkscrew. Frustrated by the search, I retired to my deck one evening to grill hamburgers, drink 807s, and fondly recall past antenna successes. (Speaking of grilling hamburgers on the deck—it occurs to me that people used to cook in the house but go outside to use the bathroom. In today's society, we cook in the yard, then go inside to tend to our needs!)

I once built a 5/8-wavelength vertical for 75 meters. Boy, did it work like a champ! I even wrote an article about it for *73* ("The 75m DX Chaser Antenna," June, 1978) and had a lot of people write to tell me how they enjoyed building and using this unorthodox antenna.

Encouraged by that success, I set about constructing a 5-element, 75-meter log periodic antenna. A hundred dollars' worth of wire later, I had an antenna that performed so poorly that the only thing to receive my "CQ DX 75" was my neighbor's garage-door opener.

Not easily discouraged, I dug around in my 1939-vintage antenna handbook and came acoss (in, of all chapters, "Mobile Antennas") a "squalo" for 2-meter AM work. Said to be unidirectional, the squalo appeared to have possibilities for low-band work. Rotators for 75-meter arrays can, after all, get somewhat large and expensive if you don't happen to be the owner of a diesel engine shop.

Blessed with 70-foot-tall Carolina pine trees, I set about hoisting a 75-meter squalo up to the 60-foot level. It was 60 feet on each of the four sides of the square and fed with 50-Ohm coax. The swr was a reasonable 1.8:1. Signal reports were equally encouraging (nothing great, but at least as good as my inverted vee at the same height).

Proud of my work, I showed off the squalo to my father, WA4GBE. He studied it for a minute or so and then, displaying the wisdom of his years, said, "It's nothing but the driven element of a quad, laid on its back. Why don't you put a reflector element under it, and you can shoot 6 or 7 dB straight up into the sky?" It hurts when the ole block you're supposed to be a chip off of walks away laughing about 6 or 7 dB being hurled up into the clouds.

When he was safely out of sight, I regained my composure, did a quick calculation using a stick in the dirt, and determined that a reflector placed 0.2 wavelengths under the squalo would be located conveniently within arm's reach, only about 7 feet or so above the ground. 75-meter local signals (those that skip around in your own call district) are a product of atmospheric scatter. I deduced that an extra 6 or 7 dB of signal sent up might result in a good deal of it coming back down.

A reflector loop for a quad needs to be longer in length than the driven element. My pine trees were just far enough apart for the 60-foot-per-side driven element, making it difficult to come up with a way to fit a somewhat larger reflector into the same space. I considered loading coils, but it seemed much simpler just to get it as large as the space permitted and let a tuning stub make up the difference. A piece of TV twinlead was attached to the reflector and pulled along head high toward the center of the square.

Beginning 10 feet or so from its attachment to the reflector element, I began sticking a pin through the twinlead, thereby shorting together the two plastic-encased wires. My swr reading was up around 3.0:1 when I first checked it. Moving the pin a foot at a time, I finally found a point about 18 feet down the twinlead where the swr was back to a respectable level between 1.5:1 and 2.0:1.

Read on to the next paragraph—it's the old "tried it on the air and got nothing but 40 over 9 signal reports" testimonial!

The original squalo was roughly equal in performance to my inverted vee, making a test of the virtues of the "laid-back quad" fairly easy. Sure enough, on-the-air tests showed that a goodly portion of the theoretical 6 or 7 dB blasting off into the atmosphere was making its way back down to add to the QRM on 75 meters. It didn't do as much for my signal as when I added "Godzilla" (the old 4-1000A amplifier I drove with an SB-200) to the quad a year before, but it was good for one to two S-units over the inverted vee.

Not everyone has four conveniently located 70-foot pine trees with which to work. Even 45–50-foot supports will work well if the reflector is placed on the ground or slightly under the surface (known as a worm warmer). I once used this method at another QTH and found its performance equal to the above-ground version. I have talked about this antenna quite a bit on the air, and one day a fellow in Minnesota broke into a QSO to tell me he had tried my design but with a delta-loop arrangement since he had only three tall supports. According to him, it also was a real "signal pumper." His signal supported the claim.

Ollie, I'm still looking around for just the right cylindrical object to use as a winding form for my 75-meter helix. If you think of anything, let me know.■

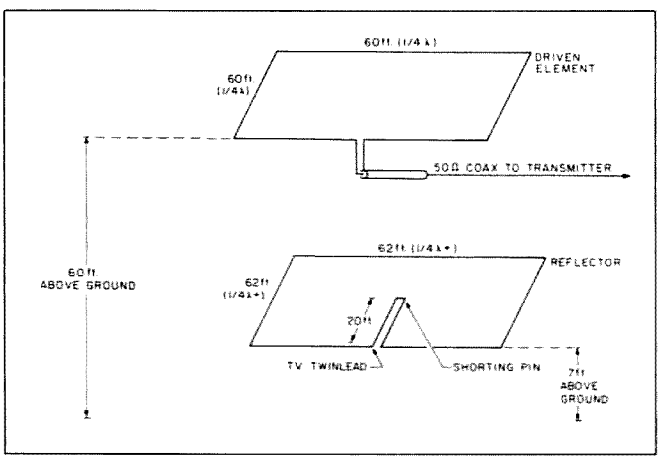


Fig. 1. The 75-meter laid-back quad.

David Whitby
c/o 73 Magazine

Kit Corner: Build A Two-Tube Vintage Receiver

Excerpted with permission from Electronics Australia.

Of all the sets built by hobbyists since the 1920s, the allband one- or two-tube sets with plug-in coils were probably the most popular. Of these, the Reinartz circuit (Fig. 1) was undoubtedly the best known.

The basic circuit was devised by J. L. Reinartz and was published in the June, 1921, issue of *QST*. The set was of the "leaky-grid" regenerative detector type. It employed a spider-web coil with switched taps to cover various bands, and featured variable-capacitor control of the regeneration. It was this capacitive control that was the main distinguishing feature of the Reinartz circuit.

Previous methods of regeneration control included the "swinging reaction coil," the tuned-anode variometer, and other methods which used a fixed-reaction coil coupled to the tuning coil and which controlled the amount of reaction by varying the filament or anode voltage of the tube.

All of these methods worked (some more so than others) on the long and medium wavelengths, but when it came to operation on the shorter bands, the reaction control became very tricky. An unstable receiver was often the result. The Reinartz circuit quickly became popular mainly due to the smooth reaction control on the shorter wavelengths.

Simply explained, the reaction capacitor is in series with the reaction coil and is thus able to control the rf current through this coil. Adjustment of the capacitor provides precise control of the amount of positive feedback (regeneration) in the circuit.

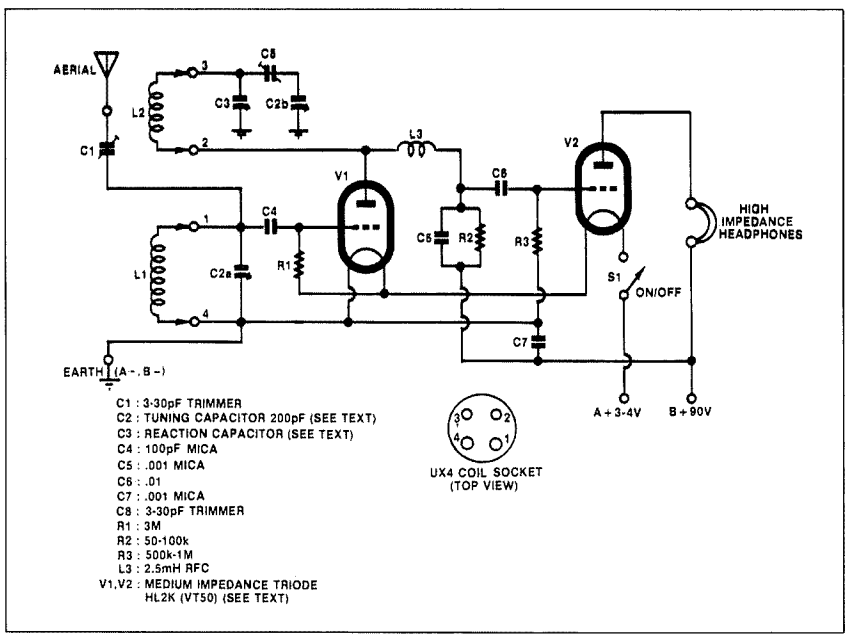


Fig. 1. Schematic diagram of the Reinartz all-wave receiver.

Circuit Details

Take a look at the circuit in Fig. 1. Signals from the aerial are coupled via C1 into the tuned circuit comprising L1 and C2A. Frequencies selected by the tuned circuit are detected by the grid of V1 which, together with C4 and R1, forms a leaky-grid detector. To improve the sensitivity of the detector to weak signals, grid-leak resistor R1 is connected to the positive side of V1's filament.

Regeneration is accomplished by the combination of L2 and C3, which feeds back some of the rf energy in such a way as to aid the original signal and bring about a great increase in gain and selectivity. The setting of C3 controls the amount of regeneration, with the optimum setting being just short of the point of oscillation (marked by a high-pitched howl).

L3 is an rf choke that prevents loading of the regeneration system by the following stage. It also operates in conjunction with bypass capacitor C5 to prevent rf currents from passing to the output stage. An rf choke in this position is always a feature of the Reinartz circuit.

Audio signals developed across V1's load resistor (R2) are coupled via C6 into the grid of V2, which drives the headphones.

It should be noted that the filaments are connected in series. This is done to provide an effective negative grid bias voltage for V2, obtained by virtue of the fact that both sides of V2's filament are positive with respect to the grid, which is at ground potential through R3.

C7 is an rf bypass capacitor across the B supply, and S1 switches power to the set by making or breaking the filament supply. The set requires an A battery of 3.4–5 volts at 100 mA, and a B battery of about 90 volts at 1.5 mA. Two heavy-duty D cells provide a suitable supply for the filaments, while a string of ten 9-V batteries will handle the B requirement.

The radio is built on a Meranti wood base, which has a "cove" routed edge. The tuning and reaction controls, the power switch, and the headphone jack are mounted on a front panel of gold-lettered black Bakelite™. A rear sub-panel, also of Bakelite, holds most of the other components, including the coil and tube sockets, and the terminals for the aerial and power supply connections.

". . . with correctly adjusted regeneration, the set performs as well as much larger sets do without regeneration."

On the Air

For best results, an outdoor aerial of from 10 to 30 meters long, mounted as high as possible, is desirable. However, quite respectable results can be achieved with a good indoor aerial in many locations.

When you are trying the set on any band for the first time, start with the reaction capacitor plates fully out of mesh and vary the setting of the tuning capacitor. You will probably hear some stations, though they will sound weak.

Now tune so that the station you want comes in as loudly as is possible. Then gradually turn the reaction capacitor so that the plates mesh. The loudness of the signal will increase as you do this, and if you now check the setting of the tuning capacitor you will find that it has shifted slightly. After a little practice, you will be able to tune the set very accurately in just a few seconds.

At the higher frequencies, the setting of both controls becomes more critical, and more skill is required to obtain the best results. You may find it easiest to make tuning a two-handed job. In any case, it is interesting to note that with correctly adjusted regeneration, the set performs as well as much larger sets do without regeneration.

Build the Kit

Dick Smith Electronics offers a complete kit for construction of the two-tube Reinartz receiver, including four hand-wound coils which cover 560 kHz to 19 MHz. Order kit number K-9000 ($99.95 plus $5 shipping) from Dick Smith Electronics, PO Box 2249, Redwood City CA 94064; (800)-332-5373.■

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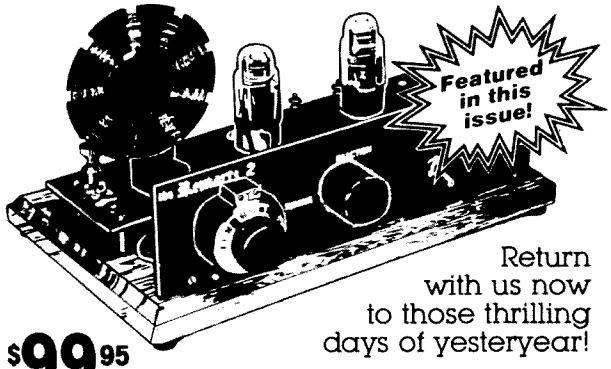
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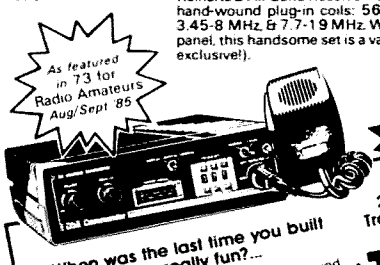


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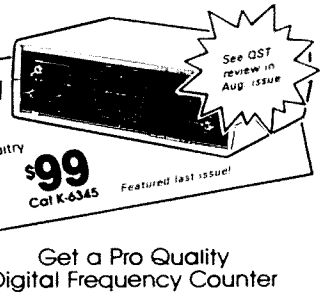


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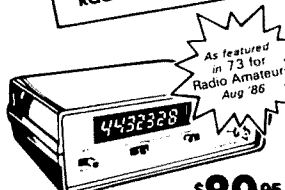
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Using a Radio Shack Color Computer (CoCo), $3.00 worth of parts, and less than an hour of work, you can produce a circuit which will help you automatically test your NiCd batteries and keep them in tip-top shape.

Keeping NiCd batteries at their peak performance involves more than just charging them every night. It's nice to think that this always will make your hand-held radio ready to go the next day, but the fact is that NiCds require a periodic deep discharge to avoid a reduction in their charge capacity.

This is easy to do with a single cell—just put a load on it and wait until cell voltage drops to zero—but doing the same with multi-cell batteries can ruin them. The weak cells (which discharge first) continue to get the current from the good cells, but in a direction which reverses their cell voltage. This results in permanent damage.

Since usually we cannot disassemble a multi-cell battery into individual cells, this leaves the problem of how to discharge the battery by just the right amount—not too much, not too little. The usual rule of thumb is to monitor the battery voltage during discharge and disconnect the load when the total battery voltage drops to about 1.0 or 1.1 volts per cell. For example, a NiCd rated at 10.8 volts has nine cells; we can determine this by knowing that the rated output voltage of a single NiCd cell is 1.2 volts and 10.8 divided by 1.2 is 9. We should, therefore, stop discharging such a battery somewhere between 9.0 and 9.9 volts.

What we need, then, is a circuit which will monitor the battery voltage and disconnect the load as soon as the voltage drops to the required value. In addition, it might be useful if this circuit also could keep records on battery voltage during discharge and tell us how long it took to discharge the battery. This information could tell us what shape the battery is in. This is where a computer can become very useful, as it can completely automate a process which could take several hours, make sure to discharge the battery enough to be useful but prevent excessive discharge, and keep printed records as well.

As it turns out, the CoCo has some circuitry which makes it a natural for this job. It has a built-in analog-to-digital (A/D) converter which can be used to monitor the battery voltage and it has a relay which can be used to turn the load on and off. It has a video display which can be used to give us information about what it is doing, and it allows us to print a permanent record of battery data on a printer.

The A/D Converter

The analog-to-digital converter in the CoCo is actually part of the joystick circuitry. Unlike the joysticks on many other computers, which use switches and allow the computer to detect only the joystick direction, those on the CoCo use a pair of potentiometers which turn with the position of the stick. One pot monitors left-right movement while the other monitors movement forward and back. In addition to direction, the computer actually can determine how far the joystick has been moved.

Internally, the joystick potentiometers are connected as shown in Fig.1. Each joystick pot is connected between +5 volts and ground and outputs a voltage ranging from 0 volts at the bottom to +5 volts at the top. Since there are four pots (two in each joystick) and only one A/D converter, a 4-input multiplexer is in the middle. The multiplexer acts like a 4-pole selector switch which chooses which pot signal is fed to the A/D converter at any one time.

The A/D converter converts the input voltage into a 6-bit binary number. The largest 6-bit binary number is 111111, the equivalent to a decimal 63, so 0 volts corresponds to an A/D output of 0, while +5 volts corresponds to an output of 63.

The A/D output values can be sampled directly from Color Computer Basic with the JOYSTK function. For example,

A = JOYSTK(0)

would make A equal to the value obtained from the first potentiometer, and so on.

Since the A/D converter accepts a maximum input of +5 volts, and most hand-held radio batteries run between 7 and 15 volts, we need to reduce the applied voltage. This is most easily done with a simple voltage divider consisting of two resistors, as shown in Fig. 2.

The formula for calculating the voltage to the joystick input is: Joystick Voltage = Battery Voltage x Rb/(Ra + Rb). If only standard value resistors are used, it may not be possible to reduce the voltage to just the right amount. For example, with the resistors shown, this circuit cuts down the 15 volts of a battery to about 4.7 volts (depending on the exact resistor values). As it turns out, this is ideal because 15-volt batteries provide over 16 volts just after being fully charged. Assuming the resistors are exactly the rated values, this circuit will drop 16 volts down to exactly 5 volts, but the exact voltage drop will depend on the exact resistor values.

Knowing that a 16-volt input produces an output of 63 from the A/D converter, we need some

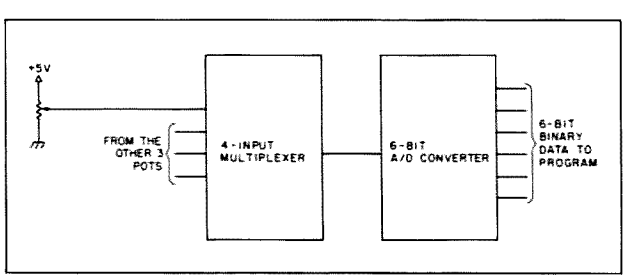


Fig. 1. Joystick connections in the CoCo.

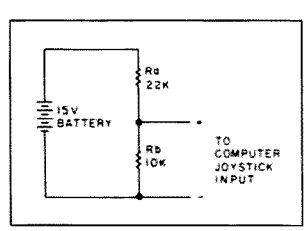


Fig. 2. Voltage divider for reducing battery voltage to a value within the range of the A/D.

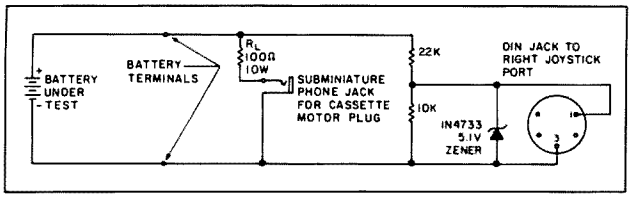


Fig. 3. Complete circuit.

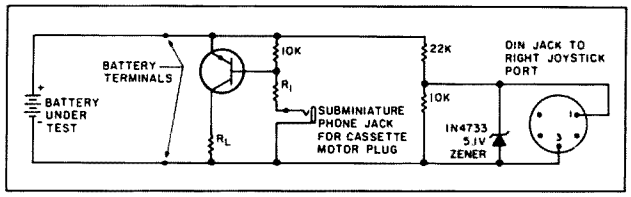


Fig. 4. Modified circuit for higher discharge current.

way of computing the voltage if we know the joystick A/D converter output. This is simply done by multiplying the A/D number by a constant, K, where K is found from the formula: K = Full-scale Voltage/63 = 16/63 = 0.254. Multiplying a reading of 63 by 0.254 gives us 16 volts.

As before, this is the theoretical formula, but in practice a slightly different value for K may be needed because of resistor errors. This may require a calibration procedure, described later. (For example, in my system, I use K = 0.26. The maximum voltage reading then becomes 63 x 0.26, or 16.38 volts.)

Since the A/D output is always an integer between 0 and 63, it changes only in steps of 1. Hence, the measured voltage changes in steps of K volts. For example, if I input 15 volts into the circuit in my system, my A/D converter outputs a value of 58. I then multiply this value by 0.26, which gives me a value of 15.08 volts instead of exactly 15 volts.

Notice that the resulting value is not entirely correct. This is due to the fact that a 6-bit A/D converter has only 64 different possible output values, ranging from 0 to 63. This splits the allowable voltage range into 64 possible values, and the A/D converter cannot measure any closer than that. In my particular unit, the minimum voltage reading is 0.26 times 0, or 0 volts. The next higher indication occurs when the A/D converter outputs a 1, which translates into a voltage of 0.26 times 1, or 0.26 volts. Any voltage below 0.26 volts will always read as 0; any voltage between 0.26 volts and 0.52 volts will always read as 0.26 volts, and so on. This means that any computer voltage measurement can always be off by as many as K volts.

Though this is not the world's greatest accuracy, it is certainly good enough to monitor the voltage of a battery to a reasonable accuracy.

The Load Relay

The second essential part needed for this application is a relay which can be used to control battery charge and discharge. In the case of the CoCo, such a relay is already built in—it's intended to turn a cassette-recorder motor on and off. The only disadvantage is that the relay's current-handling capacity is limited.

Although Radio Shack does not specify the rating of the cassette motor relay, my guess would be that it can handle 250 milliamperes safely, and perhaps as much as 500 mA. As long as we make sure not to exceed this current, there is no problem. The relay can be controlled quite easily from Basic with the two statements, MOTOR ON (to close the contacts) and MOTOR OFF (to open them).

The Full Circuit

When we put these two parts together, we get the circuit in Fig. 3. The circuit uses a 100-Ohm, 10-Watt, wire-wound resistor as the load resistor, R_L. To simplify connection to the computer's cassette motor relay, we put a subminiature phone jack (Radio Shack 274-292) in series with the resistor; this matched the subminiature plug at the end of the cassette cable.

The output of the voltage divider connects to the right joystick port through a DIN connector (Radio Shack 274-020), as shown in the diagram. An optional 5.1-volt zener diode (Radio Shack 276-565) protects the joystick input from accidental application of voltages above 5.1 volts or below zero.

I chose a 100-Ohm load resistor (Radio Shack 271-135) in order to limit the maximum current through the cassette-relay contacts. The maximum current can be found from Ohm's Law as Maximum Current = Battery Voltage/R_L. With a 15-volt battery, this current works out to 0.15 Amperes, or 150 milliamperes. This current will discharge a 450-mAh battery in approximately three hours.

Since discharge current depends on the battery voltage, batteries with a lower voltage will discharge more slowly. Table 1 gives figures for a few typical hand-held radio batteries.

This seems like a reasonable compromise between circuit simplicity and discharge time, but it is possible to lower the value of R_L as long as the relay current does not go past about 250 mA. (If you insist on discharging your battery faster, then you must modify the circuit by either adding a second relay or adding the transistor-switching circuit in Fig. 4. In this circuit, the PNP transistor must be large enough to handle the current without overheating—and should be mounted on a heat sink—and resistor R1 should have a value about 20 times the value of R_L to provide enough base current to the transistor to fully saturate it.)

The Program

The program to control the circuit can be as simple or as complex as you want it. For example, the program to discharge a 15-volt battery to 13 volts and then disconnect the load could be as simple as:

```
10 MOTOR ON
20 V = JOYSTK(0) * 0.26
30 IF V >= 13 THEN GOTO 20
40 MOTOR OFF
```

This program simply closes the motor relay and then loops in lines 20 and 30 as long as the battery voltage is 13 volts or more. Once the voltage drops below 13 volts, it goes to line 40 and shuts off the load by opening the motor relay. Though the above program works, the computer is capable of doing much more. The program listing shows the program I use.

When you start the program, the first screen is a menu listing the possible choices at that point. You may get the following menu at any time by pressing the H (Help) key:

```
BATTERY TEST PROGRAM
BY PETER A. STARK K2OAW
C—CALIBRATE
H—HELP
L—TURN LOAD ON
N—TURN LOAD OFF
P—PRINT ON PRINTER
S—START TEST
V—ADJUST VOLTAGE CUTOFF
```

Calibrate. As described earlier, the value of K may have to be adjusted for best accuracy. Although the program sets K equal to 0.26 (my value), another value may be more accurate for your particular combination of resistors. The Calibrate mode lets you adjust K for best results. Simply connect your battery to the circuit, connect an accurate meter across the battery, and press C. The program will display the following:

```
PRESENT CONVERSION CONSTANT
IS .26
ENTER MEASURED VOLTAGE;
(MINUS NUMBER TO QUIT):
```

You should now enter the actual measured battery voltage, and the new value of K will be displayed and placed into the program. (Once you calibrate the voltage reading this way, you may find it more convenient to put the correct value of K into line 70 of the program so you don't have to do the calibration each time you use your circuit.)

Help. You may press H at any time that the

Radio	Battery Rating	Current (mA)	Discharge Time
5-W HT-220	15 V, 450 mAh	150 mA	3 hours
1-W HT-220	15 V, 225 mAh	150 mA	1.5 hours
Yaesu FT-208R	10.8 V, 450 mAh	108 mA	4.2 hours
Kenwood TH-21AT	7.2 V, 180 mAh	72 mA	2.5 hours

Table 1. Ratings for some radio batteries.

```
10  CLEAR 5000
20  DIM T$(255), VO(255)
30  NE=1
40  MOTOR OFF
50  L=0                         'LOAD FLAG
60  GOSUB 1000                  'HELP SCREEN
70  K=.26                       'A/D CONV CONSTANT
80  T=255                       'TIMER ACCUMULATOR
90  P$=""                       'PREV INKEY CHARACTER
100 PT=0                        'PREV TIME
110 C=0                         'CUTOFF VOLAGE
120 M=0                         'REPORT TIME IN MIN*3600
130 PM=0                        'PREV REPORT TIME
140 A$=INKEY$
150 IF A$=P$ THEN 240
160 P$=A$
170 IF A$="C" THEN GOSUB 1500
180 IF A$="H" THEN GOSUB 1000
190 IF A$="L" THEN GOSUB 2000
200 IF A$="N" THEN GOSUB 2500
210 IF A$="P" THEN GOSUB 3000
220 IF A$="S" THEN GOSUB 3500
230 IF A$="V" THEN GOSUB 4000
240 GOSUB 500                   'GET TIME
250 IF T$="" THEN 140
260 PRINT @0, "TIME  ";T$
270 GOSUB 4500                  'READ V
280 PRINT "VOLTAGE "; V
290 PRINT "LOAD ";
300 IF L=0 THEN PRINT "OFF" ELSE PRINT "ON"
310 PRINT "----------------------------------"
320 IF INT(CT/M)=PM THEN 370
330 PM=INT(CT/M)
340 PRINT @480, T$, V
350 IF P=-2 THEN PRINT #-2, T$, V
360 IF NE<256 THEN T$(NE)=T$ : VO(NE)=V : NE=NE+1
370 IF C<>0 AND V<C AND L=1 THEN GOSUB 2500 : SOUND 180,50 : SOUND 200,20
380 GOTO 140

490  ' COMPUTE THE TIME

500 IF T=255 THEN T$="" : RETURN
510 TI=TIMER
520 IF TI<PT THEN T=T+1
530 CT=T*65536+TI
540 PT=TI
550 TI=T*65536+TI
560 A=INT(TI/216000)
570 TI=TI-A*216000
580 GOSUB 680
590 T$=A$+":"
600 A=INT(TI/3600)
610 TI=TI-A*3600
620 GOSUB 680
630 T$=T$+A$+":"
640 A=INT(TI/60)
650 GOSUB 680
660 T$=T$+A$
670 RETURN
680 A1=INT(A/10)
690 A=A-A1*10
700 A$=CHR$(A1+48)+CHR$(A+48)
710 RETURN

1000  'HELP SCREEN

1010 CLS
1020 PRINT "     BATTERY TEST PROGRAM"
1030 PRINT "   BY PETER A. STARK, K2OAW"
1040 PRINT @128
1050 PRINT "C - CALIBRATE"
1060 PRINT "H - HELP"
1070 PRINT "L - TURN LOAD ON"
1080 PRINT "N - TURN LOAD OFF"
1090 PRINT "P - PRINT ON PRINTER"
1100 PRINT "S - START TEST"
1110 PRINT "V - ADJUST VOLTAGE CUTOFF"
1120 RETURN

1500  'CALIBRATE K

1510 IF JOYSTK(0)=0 THEN RETURN ELSE CLS
1520 PRINT "PRESENT CONVERSION CONSTANT IS ", K
1530 PRINT "ENTER MEASURED VOLTAGE; (MINUS  NUMBER TO QUIT)""
1540 INPUT V
1550 IF V<0 THEN 1000
1560 IF V=0 THEN 1580
1570 K=V / JOYSTK(0)
1580 PRINT "NEW CONVERSION CONSTANT IS ", K
1590 RETURN

2000  'TURN ON LOAD

2010 IF L=1 THEN RETURN ELSE L=1
2020 GOSUB 4500 : PRINT @480, "NO LOAD VOLTAGE"; V
2030 IF P=-2 THEN PRINT #-2, "NO LOAD VOLTAGE"; V
2040 MOTOR ON
2050 GOSUB 500                  'GET TIME
2060 IF P=-2 THEN PRINT #-2, "LOAD ON AT  "; T$
2070 PRINT "LOAD ON AT  "; T$
2080 GOSUB 4500 : PRINT "LOADED VOLTAGE"; V
2090 IF P=-2 THEN PRINT #-2, "LOADED VOLTAGE"; V
2100 RETURN

2500  'TURN OFF LOAD

2510 IF L=0 THEN RETURN ELSE L=0
2520 GOSUB 4500 : PRINT @480, "LOADED VOLTAGE"; V
2530 IF P=-2 THEN PRINT #-2, "LOADED VOLTAGE"; V
2540 MOTOR OFF
2550 GOSUB 500                  'GET TIME
2560 IF P=-2 THEN PRINT #-2, "LOAD OFF AT "; T$
2570 PRINT "LOAD OFF AT "; T$
2580 SOUND 230,2
2590 RETURN

2600  'PRINT ON PRINTER
3000 CLS
3010 PRINT "   PRINT MENU" : PRINT
3020 PRINT "P - PRESENT DATA"
3030 PRINT "D - SAVED DATA"
3040 PRINT "G - GRAPH SAVED DATA"
3050 PRINT "ANYTHING ELSE - QUIT"
3060 A$=INKEY$ : IF A$="" THEN 3060
3070 IF A$="P" THEN 3110
3080 IF A$="D" THEN 3170
3090 IF A$="G" THEN 3250
3100 RETURN

3110  'PRINT TIME

3120 GOSUB 500 : GOSUB 4500
3130 IF T$="" THEN RETURN
3140 PRINT #-2, "TIME = "; T$; "   VOLTS ="; V
3150 CLS : RETURN

3160  'PRINT SAVED ARRAY

3170 IF NE=1 THEN CLS : RETURN
3180 PRINT #-2, "TIME", "VOLTS"
3190 FOR I=1 TO NE-1
3200     PRINT #-2, T$(I), VO(I)
3210 NEXT I
3220 PRINT #-2
3230 CLS : RETURN

3240  'GRAPH SAVED DATA

3250 IF NE=1 THEN CLS : RETURN
3260 FOR I=1 TO NE-1
3270     A=INT(VO(I)/K/2 + .1)
3280     IF A>14 THEN PRINT #-2, VO(I); TAB(A); "**"
3290     IF A<=14 THEN PRINT #-2, TAB(A); "**"; TAB(18); VO(I)
3300 NEXT I
3310 PRINT #-2
3320 CLS : RETURN

3500  ' START TEST

3510 CLS : PRINT "STARTING TEST"
3520 GOSUB 4500 : PRINT "PRESENT VOLTAGE IS "; V
3530 PRINT "PRESENT TIME = 00:00:00"
3540 PRINT "HOW OFTEN DO YOU WANT DATA (IN"
3550 INPUT "   MINUTES)"; M
3560 IF M<=0 OR M>60 THEN 3540
3570 M=M*3600
3580 GOSUB 4000                 'GET VOLTAGE CUTOFF DATA
3590 INPUT "REPORT ON TV OR PRINTER"; A$
3600 IF LEFT$(A$,1)<"T" THEN P=0 ELSE IF LEFT$(A$,1)="P" THEN P=-2 ELSE GOTO 3590
3610 TIMER = 0 : T=0 : PT = 0
3620 GOSUB 2000
3630 RETURN

4000  'DEFINE NEW VOLTAGE CUTOFF
4010 GOSUB 4500 : PRINT "PRESENT MEASURED VOLTAGE IS     "; V
4020 PRINT "PRESENT CUTOFF VOLTAGE IS", C
4030 PRINT "DO YOU WANT TO SPECIFY A NEW "
4040 PRINT "   V - VOLTAGE CUTOFF"
4050 PRINT "   P - PERCENTAGE CUTOFF"
4060 PRINT "   L - LEAVE AS IS? "
4070 A$=INKEY$ : IF A$="" THEN 4070
4080 IF A$="V" THEN 4120
4090 IF A$="P" THEN 4150
4100 IF A$="L" THEN 4200
4110 GOTO 4030
4120 INPUT "ENTER VOLTAGE"; C
4130 IF C<=0 OR C>17 THEN 4120
4140 GOTO 4200
4150 INPUT "ENTER NOMINAL VOLTAGE"; C
4160 IF C<=0 OR C>16 THEN 4150
4170 INPUT "ENTER PERCENTAGE AT WHICH TO CUT"; P
4180 IF P<=0 OR P>100 THEN 4170
4190 C=C*P/100
4200 PRINT "NEW CUTOFF WILL BE AT "; C
4210 RETURN

4500  'READ VOLTAGE

4510 V = JOYSTK(0) * K
4520 V = INT (V*100 + .5) / 100
4530 RETURN
```

Program listing.

program is running to get the menu, but if you remember the commands you need not get the menu—you can just type the required single-letter command at any time.

Load, No Load. These two commands simply operate the load relay. Each time you do so, the corresponding time will be displayed on the screen or printer.

Printing. P will give you a new menu:

PRINT MENU
P—PRESENT DATA
D—SAVED DATA
G—GRAPH SAVED DATA
ANYTHING ELSE—QUIT

All of these commands require a printer. C prints the current time and battery voltage; D and G print and graph, respectively, saved data (more on this later).

Start Test. This is the command which starts the battery test process. Pressing S will give you the following:

STARTING TEST
PRESENT VOLTAGE IS ...
PRESENT TIME = 00:00:00
HOW OFTEN DO YOU WANT DATA (IN MINUTES)?

At this point, you specify how often you

want the program to print or display the time and voltage. Then the program continues with

```
PRESENT MEASURED VOLTAGE IS...
PRESENT CUTOFF VOLTAGE IS 0
DO YOU WANT TO SPECIFY A NEW
  V—VOLTAGE CUTOFF
  P—PERCENTAGE CUTOFF
  L—LEAVE AS IS?
```

The present measured voltage is the battery voltage as currently measured with no load. The cutoff voltage is the minimum voltage you want the battery to discharge to before disconnecting the load resistor. This value is set in line 110 of the program and presently defaults to 0 volts, but you can change line 110 to default to any other value.

Alternatively, you can specify a new cutoff voltage at this point in one of two ways—as an actual voltage (with the V option) or as a percentage of rated voltage (with the P option). If you choose P, then the program will ask you for the nominal battery voltage and a percentage at which to cut off the load. For example, to discharge a 15-volt battery down to 90% of its rated voltage (i.e., 13.5 volts) you would enter 15 volts and 90 percent.

The final question will be REPORT ON TV OR PRINTER? You can answer with either TV (or just T) or PRINTER (or just P). If you have a printer, then the P option will print the time and voltage on the printer; the T option will display only on the TV screen.

Once you answer this final question, the program closes the load relay and starts to monitor the battery voltage. The top of the screen will display the present data like this:

```
TIME 00:00:00
VOLTAGE 15
LOAD ON
```

The time will increment each second and the battery voltage will be displayed continuously below it. At the same time, the bottom of the screen (and the printer, if you have selected it) will keep track of time and battery voltage. For example, Fig. 5 shows the printed display for a very weak 15-volt, 225-mAh Motorola HT-220 battery.

In addition to displaying or printing the time and voltage, the program also saves these in the T$ (time) and VO (voltage) arrays dimensioned in line 20. The D and G options in the print menu allow us to print or graph this data after the test is completed. The graph routine is set up for a 32-column printer (such as the Radio Shack TP-10), so it is very low resolution; you may want to remove the /2 in line 3270 to get a wider display on better printers. Fig. 6 simulates the graph for the data shown in Fig. 5; the vertical axis is voltage and the horizontal axis is time.

Calculating Battery Capacity

The clock time for the program is derived from the real-time clock of the CoCo as read by the TIMER function. It is quite accurate, although it may lose a few tenths of a second during long printouts. Since the time when the load is disconnected is printed, it is easy to determine how well the battery meets its specifications.

NiCd battery capacity is rated in mAh (milliampere hours) or Ah (ampere hours), the product of discharge current times discharge time. For example, a 1-Ah battery should last 1 hour at 1 Ampere, 2 hours at 1/2 Ampere, 1/2 hour at 2 Amperes, or 9 hours at 1/9 Ampere. In practice, though, there are two other factors which must also be considered.

```
NO LOAD VOLTAGE 15.6
LOAD ON AT 00:00:00
LOADED VOLTAGE 12.48
00:01:00          12.48
00:02:00          12.48
00:03:00          12.22
00:04:00          12.22
LOADED VOLTAGE 11.96
LOAD OFF AT 00:04:41
00:05:00          14.82
00:05:00          15.08
```

Fig. 5. Sample program printout.

First, what do we mean by a battery "lasting"? How low do we let its voltage drop before we give up on it? Most manufacturers let their batteries discharge down to either 1.1 or 1.0 volts per cell in determining cell capacity.

The second factor is the fact that the product of discharge time and discharge current varies with the rate of discharge. For example, a 1-Ah battery which lasts an hour at 1 Ampere load (which is called the "one-hour" discharge) may last slightly more than two hours at 1/2 Ampere, and slightly less than 1/2 hour at 2 Amperes.

Since discharging a battery at a lower current than the one-hour rate produces a larger time x current product, many manufacturers rate their batteries not in terms of a one-hour discharge, but in terms of two or even more hours. This complicates our calculations since we seldom know how any particular battery is supposed to be rated!

Nevertheless, assuming that the battery's mAh or Ah rating is constant results in a fairly small error. In particular, since our 100-Ohm load resistor results in discharge times of two or more hours in most cases, we should expect the product of discharge time and the discharge current to equal or exceed the battery rating—if the battery is in good shape, properly charged, and discharged down to the correct level of 1.0 or 1.1 volts per cell, depending on the manufacturer.

Hence, to calculate the actual capacity of the battery, set the discharge cutoff voltage to 1.0 or 1.1 volts per cell, let the program time the discharge, and then multiply the time in hours (convert minutes into fractions of hours) by the discharge current (which is approximately equal to the rated battery voltage divided by the value of R_L).

The only question is whether we should go down to 1.0 or 1.1 volts per cell. Although 1.0 volts per cell is used by manufacturers, in practice it might be a good idea to stop at 1.1 volts to avoid reverse-charging of weak cells. This will result in a lower apparent battery capacity, but the difference should not be more than about 10%.

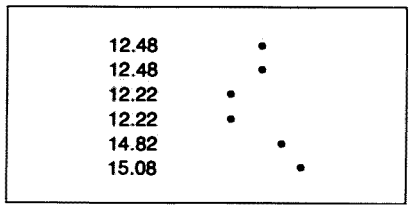


Fig. 6. Plot of data in Fig. 5.

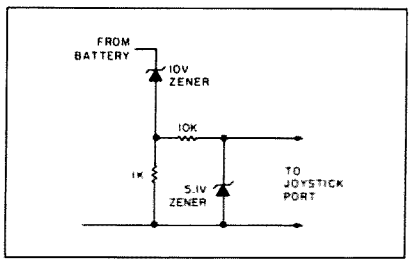


Fig. 7. Scale Expander Circuit.

Improvements

You can probably think of many ways of improving the circuit or program, but I have found it quite satisfactory for my purposes. Nevertheless, the circuit does have one disadvantage—the limited accuracy in measuring battery voltage caused by the limited resolution of the A/D converter. Although we could build a better A/D circuit, there is a much easier way of improving the resolution by a factor of two or three, and that is by expanding the scale. This involves a fairly simple change to the voltage-divider circuit as shown in Fig. 7.

In this circuit, the 10-volt zener does not conduct until the input voltage rises above 10 volts, and so the A/D converter indicates 0 output for any voltage below 10 volts. Once the battery voltage exceeds 10 volts, however, the diode subtracts 10 volts from the input and the A/D gets the battery voltage minus 10 volts. Hence, a 14-volt battery, for instance, sends only 4 volts to the A/D converter.

Now, instead of the A/D converter having to cover the entire range from 0 to 15 volts in its 63 steps, it has only to cover the range from 10 volts to 15 volts. Since it divides the range into 64 steps, the error is now just 5/64, or just about 0.8 volts. Note, though, that making such a change requires that the program also be changed to compute the actual voltage with a slightly different formula. Depending on the characteristics of the 10-volt zener diode, some additional program changes may be required to compensate for non-linearities in the voltage readout.

Conclusion

The circuit and program described here are handy applications of a small, inexpensive computer toward a very useful job. They provide a simple and cheap solution (assuming you already have the computer) to a problem which would require a fairly complex and expensive circuit if you wanted to do the same thing some other way. ■

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial offices, 73 Magazine, WGE Center, Peterborough, NH 03458-1194.

LABOR DAY TRAVEL
AUG 30–SEP 1

The Tri-City ARC will operate special-event station KA1BB from the Waterford, Connecticut, I-95 weigh station to promote safe Labor Day holiday auto travel. This event is in conjunction with the fourth annual Stay-Awake Coffee Stop offered by BSA Troop 24 of Niantic, Connecticut. Mobile operators are especially encouraged to call. Operation will be from 1700 UTC August 30 through 2300 UTC September 1 on 14.295, 7.245, and 3.395 phone and on 7.130 CW. Talk-in on 146.52 and CB channel 19. QSL via Tri-City ARC, PO Box 686, Groton CT 06340. For further information, please contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325 (work).

OK CORRAL
AUG 30–SEP 1

The Old Pueblo RC will operate special-event station W7GV from 1300 UTC August 30 to 2200 UTC September 1, from the famous OK Corral at Tombstone, Arizona, site of the famous shoot-out between the Earps and Clantons in 1881, in celebration of the Rendezvous of the Gunfighters. Frequencies: SSB—21.380, 14.280, 7.280, and 3.980; CW—14.060, 7.130, and 3.730. Send a QSL with an 8-1/2 x 11 envelope and 40 cents postage to W7GV, PO Box 42601, Tucson AZ 85733.

PLYMOUTH FALL FESTIVAL
SEP 4–7

The Stu Rockafellow ARS will operate station W8NJH on September 4–7 to celebrate its 25th anniversary, in conjunction with the Plymouth, Michigan, fall festival. Frequencies: phone—10 kHz from the lower end of the General-class bands; CW—center of the Novice bands. Certificate will be issued for QSL and SASE. QSL via W8NJH or WD8IAE.

WINDSOR ME
SEP 6

The Augusta Emergency Amateur Radio Unit will sponsor the Windsor Hamfest on September 6 at the Windsor, Maine, Fairgrounds. Gate donation is $1, camping $3 per night or $5 for two nights. Talk-in on 146.22/.82. For further information, contact Dot W1TGY and Phil Young W1JTH, 47 Longwood Avenue, Augusta ME 04330; (207)-622-1385.

UNIONTOWN PA
SEP 6

The Uniontown ARC (W3PIE) will hold its 37th annual Gabfest on September 6 on the club grounds, located on the Old Pittsburgh Road just off Rte. 51 and the 119 bypass in Uniontown, Pennsylvania, 50 miles south of Pittsburgh. $3 registration or two for $5. Free swap-and-shop setup with registration. Talk-in on 147.645/.045 and 144.57/.17. For further information, contact UARC Gabfest Committee, c/o John T. Cermak WB3DOD, 36 Steel Street, PO Box 433, Republic PA 15475; (412)-246-2870.

COACH PAUL "BEAR" BRYANT DAY
SEP 6

The West Alabama ARS of Tuscaloosa, Alabama, will operate special-event station WD4DAT on September 6 from 1300–2300 UTC, in honor of college football and coach Paul "Bear" Bryant. The station will operate on the lower 25 kHz of the General 80-, 40-, 20-, and 15-meter bands. For an 8-1/2 x 11 commemorative certificate, send your QSL and an SASE to WAARS Special Event, PO Box 1741, Tuscaloosa AL 35403, or to the callbook address of WD4DAT.

POPCORN FESTIVAL
SEP 6

The Porter County ARC will operate special-event station N9RD on September 6, from 1500–2300 UTC, to celebrate the annual Orville Redenbacker Popcorn Festival. Suggested frequencies:

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WHIPPANY AT&T 30TH
SEP 6

AT&T Bell Labs Whippany ARC will operate station W2TW on September 6 from 1300–2200 UTC to commemorate its 30th anniversary. Operation will be in the lower portions of the 10–80-meter General phone bands. A 2-meter station will operate 147.63/147.03 (W2TW) and 144.210. For a QSL, send an SASE and QSL to Rick Anderson WB2QOQ, 243 Mountain Avenue, Murray Hill NJ 07974.

NIAGARA FALLS NY
SEP 6

The Ham-O-Rama and Computerfest '86 will be held on September 6, from 7 a.m. to 5 p.m., at the Niagara Falls International Convention Center in Niagara Falls, New York. Registration is $3.50 in advance (before August 20) or $5 at the gate. Tailgating $5; $5 per 4-foot flea-market table, $7 after August 20. Exams given. Talk-in on 146.31/.91 (W2EUP) and 146.52. For more information, contact Nelson Oldfield W2ZSJ, 126 Greenaway Blvd., Cheektowaga NY 14225.

CHATTANOOGA TN
SEP 6–7

The 8th annual Hamfest Chattanooga Amateur Radio and Computer Convention will be held September 6–7 at the South Hall of the new Convention and Trade Center. 8-foot flea-market tables are $6 for one day or $10 for both days (electrical power is $10 extra). Exams given both days. Talk-in on 146.19/.79. For additional information, write to Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404, or call Nita Morgan N4DON at (404)-820-2065 (for dealer exhibitors) or Barbara Gregory WA4RMC at (615)-892-8889 (for flea market).

62ND ANNIVERSARY FAIR
SEP 6–7

The Hen House Gang ARC of Bethlehem, Connecticut, will operate station W1FHP on September 6–7 during daylight hours. Frequencies will be the 10-, 15-, 20-, and 40-meter bands, SSB plus Novice CW. For a QSL, send a first-class stamp and an address label if you have one (no envelopes) to W1FHP.

MELBOURNE FL
SEP 6–7

The Platinum Coast ARS will sponsor its 21st annual Melbourne Hamfest on September 6–7 at the Melbourne Auditorium just off U.S. 1 in downtown Melbourne, Florida. Hours are 9–5 Saturday and 9–4 Sunday. Admission is $3 in advance, $4 at the door. Table reservations limited to two adjacent tables. Exams given. Talk-in on 146.25/.85. For more information, send an SASE to PCARS, PO Box 1004, Melbourne FL 32901. Mark the envelope "Tables" for table reservations or "Exams" for exam information.

BATTLE OF LAKE ERIE
SEP 6–7

The Radio Association of Erie, Pennsylvania, will operate station W3GV, from 9 a.m. to 9 p.m. on September 6 and from 9 a.m. to 5 p.m. on September 7, to commemorate Commodore Oliver Hazzard Perry's victory at the Battle of Lake Erie during the War of 1812. Frequencies will be 7.235 and 14.235 phone; 7.090 and 14.090 CW/RTTY. Special QSL via W3GV, PO Box 844, Erie PA 16512, or W3 QSL Bureau for DX stations. Include a business-size SASE.

NORWALK CT
SEP 7

The Fairfield, Norwalk, Stamford, and West Haven ARAs will sponsor the Fairfield County Hamfest on September 7, from 9 a.m. to 5 p.m., at the Norwalk National Guard Armory, immediately off Exit 38 Merritt Parkway. Admission is $3, tailgating $5, tables $10, power free. Talk-in on 147.39/.99 and 146.52. For early registration, write to PO Box 326, West Haven CT 06516.

LA PORTE IN
SEP 7

The La Porte and Michigan City ARCs will hold their combined Summer Hamfest on September 7 at the La Porte County Fairgrounds, located on State Road 2 on the West Side of La Porte, Indiana. Inside tables $3, paved selling area outside. Talk-in on 146.52.

BUTLER PA
SEP 7

The Butler County ARA will sponsor the Butler Hamfest on September 7, from 9 a.m. to 4 p.m., at the Butler Farm Show Grounds at Roe Airport in Butler, Pennsylvania. Mobile check-ins until noon on 147.96/.36. Directions on 147.84/.24. $1 admission, children under 12 free. Free outdoor flea market. Indoor flea market, $5 per 8-foot table. For more information, contact John K3HJH, 174 Oak Hills Heights, Butler PA 16001; (412)-283-9403.

MISS AMERICA PAGEANT WEEK
SEP 7–14

The Southern Counties ARA will operate special-event station K2BR during the week of September 7–14, from the Miss America Pageant in Atlantic City, New Jersey. Frequencies: phone—the lower 25 kHz of the General-class band; CW—the lower 65 kHz; 7.125 and 21.150 in the Novice band. For a QSL send your QSL and an SASE to SCARA, Box 121, Linwood NJ 08221.

LOS ALTOS HILLS CA
SEP 13

The Foothills ARS will hold a flea market on September 13 from 8 a.m. to 2 p.m. at the Foothill Junior College, I-280 and El Monte Road, Los Altos Hills, California, parking lot "B." Sellers $7, others free. Sellers get two parking spaces. Talk-in on 145.27/144.67. Exams given 12 noon. For information, call (408)-255-9000.

ROBINSON 100TH
SEP 13–14

The Crawford County ARC will operate its club station WA9ISV on September 13 and 14 from 9 a.m. to 6 p.m. EDT to commemorate the centennial of Robinson, Illinois. Operation will be on the following frequencies: 7.250, 14.250, and 21.350 ± QRM. Local-area hams may use 147.96/.36. For a certificate, send QSL and 9-1/4 x 14-1/4 SASE to CCARC, or for more information, contact Ray Everly WB9SVH, 310 E. Magnolia Street, Robinson IL 62454; (618)-544-3709.

ARBORETUM DAYS
SEP 13–14

The Great River ARC will operate special-event stations WØLBR and WBØQMA from the Dubuque, Iowa, Arboretum on September 13–14, from 1500–2100 UTC, to celebrate Dubuque Riverfest and Arboretum Days. Frequency for station WØLBR will be 7.115 ±5 kHz in the Novice band. Frequency for station WBØQMA will be the lower 20 kHz of the General-class band. QSL to Cliff Stanton WØLBR, 1260 Madera Street, Dubuque IA 52001 or to Gene Chappel WBØQMA, 1795 Hale Street, Dubuque IA 52001.

JACK LONDON STATE PARK
SEP 13–14, 20–21

The Valley of the Moon ARC will operate special-event station N6KM on September 13–14 and 20–21 from 8 a.m. Saturday to 6 p.m. Sunday. The station will operate from the Wolf House in Jack London State Park in Glen Ellen, California, to commemorate the author. Operation will be in the General phone band on 21.360, 14.275, and 7.225, ± depending on QRM. For an 8-1/2 by 11 commemorative certificate, send QSL, SASE, and $1 to VOMARC, 358 Patten Street, Sonoma CA 95476.

MT. CLEMENS MI
SEP 14

The L'Anse Creuse ARC will present its 14th annual Swap and Shop on September 14 from 8 a.m. to 3 p.m. at the L'Anse Creuse High School in Mt. Clemens, Michigan. Admission is $1 in advance, $3 at the door. Trunk sales, $4 per space; inside tables, $8 each. Talk-in on 147.69/.09 and 146.52. For tickets and table reservation, contact Maurice Schietecatte N8CEO, 15835 Touraine Ct., Mt. Clemens MI 48044; (313)-286-1843. Include an SASE.

CORONA NY
SEP 14

The Hall of Science ARC will hold a hamfest on September 14 (rain date Sept. 28), beginning at 9 a.m., at the Hall of Science Bldg., 111th Street and 48th Avenue, Corona, New York. For information and reservations, call John Powers KA2AHJ at (718)-847-8007 in the evenings.

CARTERVILLE IL
SEP 14

The Shawnee ARC will hold its annual hamfest on September 14, beginning at 7 a.m., at John A. Logan College Gym on Hwy. 13 near Carterville, Illinois, nine miles east of Carbondale, Illinois. Admission is $3. Exams given Sunday morning. Talk-in on 146.25/.85, 146.52, and 3.925 (8–9 a.m.). For more information, contact Shawnee Radio Association, 502 West Kenicott, Carbondale IL 62901; (618)-457-7586.

DANBURY CT
SEP 14

The Candlewood ARC will hold

its annual hamfest and flea market on Sep. 14, from 9 a.m. to 3 p.m., at the Danbury Elk's Club, 346 Main St., Danbury CT. Admission is $2, kids under 12 free. Tables are $8, including one admission. Tailgaters $5. Talk-in on 147.72/.12. For *more information*, contact Gene Marino W1IDH, 27 Valley View Road, Newtown CT 06470; (203)-426-8852.

FARGO ND
SEP 19–21

The Red River Radio Amateurs will sponsor the Dakota Division Convention on September 19–21 at the Holiday Inn, I-29 and 13th Avenue South, Fargo, North Dakota. Registration begins at 4 p.m. on Friday. Admission is $7. $5 per table *for indoor flea market*. Preregistered exams given. Talk-in on 146.76. For more information, send an SASE to The Red River Radio Amateurs, Box 3215, Fargo ND 58108-3215, or call W0LHS evenings at (701)-232-0310.

BARRIE ONT
SEP 20

The Hex-9 Group of the Barrie ARC will hold its 2nd Packet Radio Symposium on Sep. 20, with flea market in the a.m. Co-sponsored by and held at Georgian College, Barrie, Ontario. Admission is $5. Talk-in on 146.25/.85. For more information, contact Hex-9 Group, Box 151, Orillia, Ontario, Canada L3V 6J3.

SEBASTOPOL CA
SEP 20

The Sonoma County Radio Amateurs will hold its fourth annual Ham Radio flea market on September 20, from 8 a.m. to 2 p.m., at the Sebastopol Community Center, 390 Morris Street, Sebastopol, California, five miles west of Santa Rosa, just off Hwy. 12. Tables are $7 at the door or $5 in advance. VEC exams. Talk-in on 146.13/.73. For tickets and information, write SCRA, Box 116, Santa Rosa CA 95402.

MAPLE SHADE NJ
SEP 20

The Maple Shade ARC will *sponsor* its first annual hamfest on Sep. 20, from 8 a.m. to 2 p.m., at the Maple Shade High School, Coles Avenue, in Maple Shade, New Jersey. A $5 donation per carload includes one tailgate space. Talk-in on 223.02/224.62 and 146.52. *For more information*, contact Howard Weinstein K3HW, 15 Lakeside Drive, Marlton NJ 08053; (609)-596-3304.

PEORIA IL
SEP 20–21

The Peoria Area ARC will hold the Peoria Superfest '86 hamfest on September 20 and 21 at the Exposition Gardens, W. Northmoor Road, Peoria, Illinois. Gate opens at 6 a.m., Commercial Building at 9 a.m. Admission is $3 *in advance*, $4 at the gate. Children under 16 are free. Talk-in: call W9UVI on 146.16/.76. Exams given both days. For more information and reservations, send an SASE to Superfest '86, PO Box 3461, Peoria IL 61614.

YORK PA
SEP 20–21

The York ARC, Keystone VHF Club, Penn-Mar RC, and Hilltop Transmitting Assn. will hold the York Hamfest on September 20–21 at the York Fairgrounds, State Rte. 74, in the northeast corner of the city. Registration is $3 each day or $5 for both days. Women and children under 12 free. Tailgating $4 per day or $6 for both days. Registration begins at 8 a.m. Tables $5 and up. Exams on Saturday. Write to York Hamfest, Box W, Dover PA 17315 for reservations and additional details.

AUGUSTA GA
SEP 21

The ARC of Augusta, Georgia, will hold its annual hamfest on September 21 at Julian Smith Casino. Inside dealer tables $10. Ample room for tailgaters. Exams at 8 a.m. in the Red Cross Building, 12th Street. Talk-in on .34/.94. For additional information, send an SASE to Charles Pennington K4FRM, 4542 Glenda Lane, Evans GA 30809, or call (404)-868-8842 after 6 p.m.

NEW KENSINGTON PA
SEP 21

The Skyview Radio Society will hold its 1986 Swap and Shop Hamfest on September 21, at the club grounds on Turkey Ridge Road, New Kensington, Pennsylvania. Talk-in on 146.64/.04. For further information, call Scott Rupert N3DDZ at (412)-478-3488.

WILLIMANTIC CT
SEP 21

The Natchaug ARA will hold its 4th annual Giant Flea Market on September 21 beginning at 9 a.m. at the Elks Home, 198 Pleasant Street, Willimantic, Connecticut. Admission is $2, children under 16 free. Advance reserved tables inside $5 each, $7 at the door. Tailgaters welcome. Outside space $5 and up. Exams given. Talk-in on 147.30/.90 and .52. For more information, please contact Ed Sadeski KA1HR, 49 Circle Drive, Mansfield Center CT 06250; (203)-456-7029 (after 4 p.m.).

WESTBURY NY
SEP 21

The LIMARC will sponsor the ARRL Long Island Hamfair on September 21, beginning at 9 a.m., at the New York Institute of Technology, Rte. 25A Northern Blvd., Old Westbury, New York. Admission for hams is $3, others free. Seller's car space, $5. Outdoor tailgating, no reservations needed. Talk-in on 146.85. For further information, call Hank Wener WB2ALW at night at (516)-484-4322.

ADRIAN MI
SEP 21

The Adrian ARC will hold its 14th annual hamfest on September 21, from 8 a.m. to 3 p.m., at the Lenawee Fairgrounds in Adrian, Michigan. Advance tickets $2, $3 at the gate. Full table $6, half table $4, trunk sales $2. Talk-in on 146.310/.910 or 449.675. For information or reservations, write Adrian ARC, PO Box 26, Adrian MI 49221.

CHICAGO CLUB 60TH
SEP 21

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SIERRA VISTA AZ
SEP 27

The Cochise ARA will hold a flea market on September 27 at the CARA Training Facility on Moson Road near Sierra Vista. For more information, write CARA, PO Box 1855, Sierra Vista AZ 85636.

SANTA FE NM
SEP 27–28

The Northern New Mexico ARC will hold its third annual hamfest on September 27 and 28 at Camp Stoney, eight miles east of Santa Fe, New Mexico. Exams will be given on Saturday; there will be a tailgate flea market on Sunday. Registration is $5 for adults, $2 for children under 12. Talk-in on 146.22/.82 or 146.52. For further information, send an SASE to Alan Hill N5BGC, 2020 Calle Perdiz, Santa Fe NM 87505.

ELMIRA NY
SEP 27

The Elmira Amateur Radio Association will present its 11th annual Elmira International Hamfest on September 27, from 6 a.m. to 5 p.m., at the Chemung County Fairgrounds. Tickets are available at the gate or in advance from Steve Zolkosky, 118 East 8th Street, Elmira Heights NY 14903.

GRAYSLAKE IL
SEP 27–28

The Chicago FM Club will hold Radio Expo 86 on September 27–28 at the Lake County Fairgrounds, Routes 120 and 45, in Grayslake, Illinois. Flea market opens at 6 a.m. and exhibits at 9 a.m. Tickets $4 in advance, $5 at the gate. Indoor flea-market tables $7.50 per day, reservations by September 10. Exams given. Talk-in on 146.16/.76. For more information, send an SASE to Radio Expo 86, Box 1532, Evanston IL 60204, or call (312)-582-6923.

HARVESTER MO
SEP 28

The St. Peters ARC will hold its second annual swapfest on September 28 at the Harvester Lions Club Park, Harvester, Missouri, about six miles south of St. Charles. $1 admission. Talk-in on 145.33. For more information, contact Joe Riordan KGØK, 2760 Hwy. 40-61, O'Fallon MO 63366.

GAINESVILLE GA
SEP 28

The Lanierland ARC will hold its Hamfest '86 on September 28 at the Holiday Inn in Gainesville, Georgia, from 8:30 a.m. to 3:30 p.m. Free admission. Exams given. Talk-in on 146.67/.07. For more information, write to George D. Floyd, Rte. 11, Box 661A, Gainesville GA 30501.

WELLESLEY MA
SEP 28

The Wellesley ARS will hold its annual outdoor flea market on September 28, from 9 a.m. to 2 p.m., in the parking lot of the Wellesley Senior High School, Rice Street, Wellesley, Massachusetts. Admission is $1 for buyers, $2 for sellers. Talk-in on 147.63/.03.

WATERBURY CT
SEP 28

The Waterbury (CT) ARC will sponsor a flea market on September 28, from 10 a.m. to 3 p.m., at the Waterbury State Technical College off I-84 in Waterbury, Connecticut. Admission is $2. Indoor spaces will be $10/table, tailgating $5. Dealers and sellers should contact Gary Firtick K1EB, 589 Hamilton Avenue, Watertown CT 06795, by September 15.

BOARDMAN OCTOBERFEST
SEP 28

The Mahoning Valley ARA will operate station W8QLY on September 28 from Boardman Park during the annual Rotary Octoberfest Celebration. Suggested frequencies are the phone sections of the 40- and 20-meter bands, and 145.01 packet. For a special QSL certificate, send an SASE to MVARA Octoberfest Station, PO Box 2950, Youngstown OH 44511.

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SATELLITES

USING THE AO-10 PREDICTIONS

Apogee predictions for the month of September are provided for three sections of the United States: Washington, D.C.; Denver, Colorado; and Los Angeles, California. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

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		WASH		DENVER		LA	
DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1	0830	185	27	154	22	139	20
2	0749	174	27	144	18	131	15
3	0708	163	26	136	13	124	8
4	0627	153	23	128	8	118	2
5	0546	144	19	121	2		
6	0505	135	14				
7	0424	128	8				
8	0343	121	2				
9	1442					242	6
10	1401					235	10
11	1320			237	5	228	17
12	1239			230	11	220	23
13	1158			222	16	211	28
14	1117	237	5	213	21	200	31
15	1036	230	12	203	25	189	34
16	0955	222	17	193	27	177	34
17	0914	213	22	182	28	165	33
18	0833	203	26	170	28	154	30
19	0752	193	28	159	26	144	26
20	0712	181	29	149	23	135	20
21	0631	170	29	140	18	127	14
22	0550	159	27	132	13	120	8
23	0509	149	24	124	7	114	1
24	0428	139	19	117	1		
25	0347	131	14				
26	0306	124	8				
27	0225	117	1				
28	1324					241	7
29	1243			243	2	235	14
30	1202			236	8	227	21

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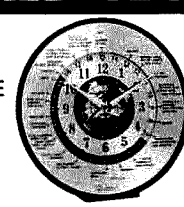
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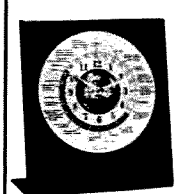
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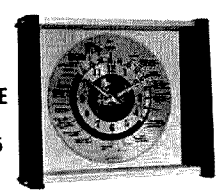


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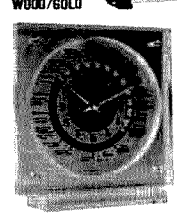
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ABOVE AND BEYOND

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Antennas, antennas! If there's a subject that holds more fascination for amateurs, I have yet to hear of it. Everybody's got a favorite design, or configuration, or manufacturer. Horizontal polarization, vertical polarization, circular polarization, yagis, quagis, loops, J-poles, whips, phased arrays, stacked arrays. . . you could go on forever.

Certainly no topic arouses more controversy either, as one person's "tried-and-true" design is quickly debunked by others. There are those who do it all by the book, and there are those who burned their books a long time ago!

I'm going to touch on some assorted topics pertaining to VHF and UHF antennas that I think are relevant (based on conversations, correspondence, and other communications throughout the past year).

Gain. . .

Now there's a truly abused term. There are many types of gain—dB, dBi, forward, etc. *QST* has determined that gain measurements can be so misleading that they won't publish them in advertisements. It's not a bad idea—after all, when was the last time you saw an isotropic dipole?

How can you really measure the gain of your antenna array? I detailed a method using formulae from MIT some months back, but this is more useful at microwave frequencies since the distance between the two antennas under test must be 100 wavelengths (at 144 MHz, that's roughly 650 feet. Not too practical!).

The accepted way is to use calibrated test equipment and establish a standard for that particular test (or round of tests). One way might be to employ a simple dipole as a receiving antenna, fixed to a tripod. A low-level signal source is placed a certain distance away. This known source of energy is recorded at its source (such as another dipole or simple whip) and an rf millivoltmeter is used to record the output from the dipole. This number doesn't mean anything really; it's just a number to reference to.

Say the number is +3 dBm. This is logged, and the test dipole is replaced with the desired array, taking care to maintain the same distance from the signal source. The output of the source is checked for accuracy, and after alignment for peak signal readings, the rf millivoltmeter is again checked. In this hypothetical case, let's say the reading might be +9 dBm. So, what does it mean?

It means that your test antenna has a gain of 6 dB over the reference antenna. That's it, and nothing more! Of course, this could be influenced by any number of things, such as atmospheric moisture content (especially at UHF), interaction of nearby conductive objects, and even the stability and accuracy of the test signal source and the rf millivoltmeter! It's easy to see why so much controversy erupts over figures of gain. About the only thing you can do with some confidence is to measure comparable antennas from different manufacturers to see how they compare to each other, and this is exactly what happens at an antenna measuring contest. But you must have accurate, stable test equipment for the numbers to mean anything.

Assuming you can obtain such equipment, measuring your own and others' antennas (such as long-boom yagis) can be a worthwhile and educational experience, as well as fodder for endless arguments over a beer! In my own tests, I've employed stable low-level signal generators with a Boonton 902 rf millivoltmeter to make such measurements. In one case, I was able to verify within .25 dB a manufacturer's claim for forward gain. However, it required two identical antennas and some careful measurements!

Stacking

Disregarding the column I wrote on stacking a few months ago so unsatisfactorily, let me tackle the subject again. Stacking does provide many benefits, among which is increased forward gain. How much? The rule of thumb would appear to be 3 dB per array, based on pure math. Based on actual experience, it might be more like 2–3 dB per array.

Note that when I say "per array," I mean a geometrically equal array. If you start out with one yagi, adding a second should increase gain by the above figure. Since the process is a square-law function, however, you need to add two more yagis to your existing two yagis to increase gain by another 2–3 dB. Start with four, and you'll need to add another four to see that extra 2–3 dB.

What advantages are to be had? In addition to gain (again, a number meaning nothing unless you reference it to some known value), the capture area of the array, or aperture, increases geometrically. This is especially useful when engaged in extremely weak signal work, such as low-level tropospheric enhancement, scatter, and, of course, moonbounce. However, you may encounter some distortion of the sidelobe pattern, based on any individual yagi in the array.

Despite the fact that this is a geometric process, the horizontal spacing between yagis in an array may not equal the vertical spacing when optimum results are achieved. A classic example of this is the RIW 432–19 yagi, where many users of four-bay RIWs report that vertical spacing is on the order of 5-1/2 feet, but horizontal spacing is about 5 feet.

The angle of radiation will change, and this is more evident on 50- and 144-MHz arrays used in over-the-horizon modes such as Es and tropo. Is there an increase in the front-to-back ratio? In many cases, yes. In some cases, no. It's a grey area, for sure, and only experimentation will yield definitive results. As far as spacing goes, the rule of thumb has been one-half the boom length, for conventional arrays. In the case of some of the "long-boom" antennas seen recently, this number will change.

Your best bet is to consult the manufacturer's literature. I've found the KLM, Cushcraft, and Tonna literature to be quite accurate and helpful in this regard, especially in regards to stacking arrays. You'll also need to make up phasing lines or use power dividers (my favorite), which are not expensive and have typical losses of .05–.08 dB per unit. It goes without saying that your phasing lines and interconnecting cables should be high quality (I use Belden 8214 up to 432 MHz, and 9913 above that), as should your connectors. No sense trying to gain an extra 2.5 dB and losing most of it in a poorly made junction!

Impedance Matching

We can go all over the place on this one. Current matching schemes in use include gamma, T-match, balun, and folded dipole. The first is quite common to users of older Cushcraft antennas. Usually, a stub in series with a capacitor is used to make the connection to the driven element. This type of match is typically used with coaxial lines, and is somewhat of an effective match. In my experiments in the past, I've noticed a somewhat narrowband characteristic of this type of match.

T-matches are commonly employed by many manufacturers, among them Cushcraft and RIW. Here, two stubs either side of the center of the driven element are adjusted for best match. The common method is to screw these adjustments tight. RIW goes one step further and solders them directly, resulting in a somewhat corrosion-proof connection. T-match systems are more broadbanded than a gamma match.

Baluns are the method employed by KLM. Two types are used: coaxial and sleeve. The coaxial balun is no stranger to the HF operator, and the principle is the same at VHF, only low-loss Teflon™ cable is used for the connection. Coaxial baluns can suck up moisture over a period of time but are fairly reliable and provide a moderately broadbanded match. Sleeve baluns are in effect a section of transmission line and work the same way, but must be installed carefully to avoid moisture accumulation over a period of time. KLM usually provides drain holes in their baluns for this purpose.

The folded dipole provides a very good match. It's broadbanded and usually made from a loop of solid wire, so moisture isn't a problem. The connections can be soldered or screwed on. KLM uses folded dipoles on their 4-element, 144-MHz yagis, but by far the biggest user is Tonna Antennas, who employ them at 432 and 1296 MHz. This type of match is my own favorite at 144 MHz and above, since it is so simple and reliable.

One other type of match is the full-wave loop, used in loop yagis or quagis (quad loops). Loop yagis are very popular at 1296 and

above, as the phenomenon of water droplets hanging from conventional dipole-type elements degrades yagi performance. With a loop element, the water runs down to the mounting bracket for the element, out of harm's way.

With vertical antennas, the principles are the same. Instead of a gamma "clip" and tuning stub, we have a tuned coil with tap feeding the driven element—basically the same thing. The difference is that a vertical antenna is an unbalanced system, feeding a radiator against ground, whereas a yagi's driven element is balanced, using a dipole.

Some Weird Designs . . .

I've heard of some good ones. Back many years ago, one of my high school pals used a longwire with splendid results on 2 meters. Yep, it's possible and it works! Consider that a 60-foot longwire is almost ten wavelengths long and will have gain off the far end. In a pinch, you can use it.

Ground planes made from coathanger wire have got to be the favorite of any apartment dweller, college student, or operator short on cash. Here's how it's done: Cut four lengths of wire 19 inches long. Cut a fifth about 20 inches long and bend a loop in one end so the actual length is still 19 inches. Now grab hold of an old SO-239 chassis connector (or type-N female) and solder the loop piece to the center pin.

Obtain four solder or crimp lugs the same size as the coathanger wire. Bare about 1/4" with a file or sandpaper on one end of each wire and attach to the crimp lugs. Now fasten them securely to the four holes in the SO-239. Attach a piece of coax to the connector and run it to your rig. You can hang the loop wire from a string or other noninductive material out of harm's way. By the way, with the ground-plane elements at 90 degrees to the center whip, the impedance is about 37 Ohms, or a 1.5:1 mismatch. If you want to get closer to 50 Ohms, bend the ground-plane elements down to about 45 degrees, and you'll be there.

Want to obtain some gain in most directions without using a rotor? You can do it with four small yagis (such as KLM or Cushcraft 4-element, 144-MHz beams) mounted around a pipe, and a surplus Transco-type relay of the 4-pole, single-throw type. Then you need but one coax feedline to the shack and a five-wire control cable for the selector box. Presto! The world's fastest antenna rotor.

Want to build it cheap? Make a quagi! It's nothing more than a yagi with full-wave loop elements instead of dipole types. And, of course, a full-wave loop is easily matched—you drive it directly. One friend used such an antenna with four elements off his apartment balcony for several years with excellent results. It was made from soft-drawn aluminum wire and a PVC boom. Best of all, you obtain polarization in both horizontal and vertical planes, making it a versatile all-around beam.

How about using a circularly polarization antenna for terrestrial work? Why not? Another ham I know did this for years with outstanding results. In fact, he never worked the satellites at all, just Es and tropo and aurora (lots of it, too!) with a KLM 144-14C. He operated under the theory that over a long enough distance, both horizontally and vertically polarized waves degrade to a somewhat circularly polarized wave. It must have worked, for with 100 Watts and the KLM he worked some mighty fine DX throughout the South and Midwest!

I'll close with my personal favorite vertical antenna: the J-pole. Imagine the gamma match described earlier feeding a dipole-driven element. Now take that same stub and half the dipole, mount them vertically, feed with coax, and use the same sliding-stub technique to make a match. Presto! An antenna you can put just about anywhere—under an eave, against the house, in a closet, on top of your tower (or on the side), on a fence, even on your car! The J-pole is simplicity personified. It's cheap to buy or make and is very durable, not to mention being the ideal apartment or condo antenna for 50, 144, 220, and 432 MHz!

That's it for this month. Let's hear from you about your favorite antenna systems or schemes! Send along some photos if you can. Soon I'll try to touch on useful test equipment you can pick up cheaply that will come in handy around the shack, and give some observations on the 1986 CQ WW VHF WPX. Until then, see you Above and Beyond! ■

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NEVER SAY DIE

from page 12

know diddley about computers. Oh, I knew the microcomputer just had to develop into a huge industry, but I didn't know how the fool thing worked or how to use it. So I set about learning computers. It wasn't long before I found I was becoming the teacher instead of the student. I kept at it and found my audiences growing. Along the way I was able to start and run some very successful computer magazines.

Amateur radio can be a key to success—if you'll let it. Persistence in radio means education. I hope you find it as exciting and as much fun learning as I do. It isn't work in its bad connotation. How much amateur radio do you know well enough to teach? Can you get up in front of your club and talk about OSCAR operating? How about packet? Slow scan?

There has been a need for years for a practical slow-scan unit for business. We've had the technology for this for well over ten years, yet I've just recently seen a practical unit marketed. Ham historians can go back through my editorials and see where I've suggested such a product several times.

With so few engineers coming out of our schools these days, there are all sorts of opportunities for sharp technicians. Sam Harris W1FZJ wasn't an engineer, but he used his amateur radio experience to become a world expert in microwaves. He's the chap who invented the first parametric amplifier and helped make Microwave Associates what they are today—Ma/com—the outfit giving the satellite business the shaft these days with their scrambling decoders.

Sam built the first parametric amplifier on six meters and I published the first article on it! Readers thought it must be an April Fool article, it was so implausible. His amateur radio work got Sam a nice spot with the big dish in Arecibo. Unfortunately, Sam smoked, so he's no longer with us. So did his wonderful wife, Helen W1HOY . . . gone too. We sure miss pioneers like Sam . . . not many left.

Call it education . . . call it doing your homework . . . it's one major separation between failures and successes. You have the best shot at getting to the big money when you start your own business, but the odds aren't very attractive. This is more because too many entrepreneurs start their businesses without doing their homework and find it's too late to learn all the things they should have known. 90% of all small businesses fail in the first five years. But darned few fail where the homework has been done.

One of these days I may be able to get schools to provide a practical business education. Did you see Rodney Dangerfield in "Back To School"? It was a fun picture, with one great bit where a pedantic college business professor is trying to teach the kids the theory of how to start a business. Dangerfield, a self-made millionaire, who has decided to get a college education and is starting in as a freshman, then points out many of the practical things you have to know to succeed, none of which have much to do with business theory. Great scene.

My advice to anyone interested in making it big with his own business is first to learn the pitfalls while working for someone else. It's dumb to learn with your own money . . . you'll run out . . . as 90% do. Heck, I worked for five years as editor of *CQ* before starting my own magazine. I'd probably still be making the publisher rich if he hadn't fired me. And he was doing very well indeed, by the way . . . pretty much retired on a big yacht. We didn't see him much. In today's dollarettes I'd estimate *CQ* was making over $1 million profit a year.

With communications starting to get into some serious growth, the need for new products and services is going to be almost unlimited. I believe the next really big technology explosion will be in communications . . . via satellites, fiber optics, cables, and microwaves. Our new-found computer power needs communications.

How many years now have I been pointing out the potential for optical data storage? It's finally beginning to emerge, as much from small firms as the giants. Until we get a re-writable optical storage system, I'd suggest someone work on a combination of optical and magnetic storage . . . the optical for high-density storage . . . perhaps a part of the disk for write-once (WORM) and a magnetic segment for indexing the data.

Getting back to education . . . if there's any real demand for theory articles in *73* I'll start a series. But if you'd rather rag-chew your spare time away, I'll just try to keep *73* fun to read and avoid straining your brain. It's up to you. I'm not talking electronic engineering, I'm just talking about your really understanding the theory you are supposed to know for an Extra-class license . . . and maybe a bit extra on digital circuits so you can cope with your ham rigs and their synthesizers.

Let me ask another question. How many technical magazines are you getting? Is the ARRL *Handbook* your ultimate reference manual?

I have a bone to pick with our schools. It's not a new one. If you've been reading anything much more than ham magazines, you know there's been a series of books published exposing the sad state of education in America. I get upset when I visit colleges and find much of their time is spent in remedial work . . . teaching things the kids should have learned in grammar and high school.

Sure, I think everyone should have an education in the arts . . . literature, art, music . . . maybe even food. I'm old enough so I had classes in all of these way before college. My idea of college is as a place to develop your skills for your business career. Artists can go to an art school . . . such as Pratt Institute. My mother went there and became an excellent artist. Musicians have the Eastman School of Music, for example. Engineers have MIT and RPI. But why should RPI have to teach music? That's ridiculous.

Should college graduates be so ill-equipped for a career that all they can do is drive a cab or empty wastebaskets. Yes, I've had college graduate wastebasket emptiers working for me.

One of my goals is to get colleges to teach not only the career material, but also to provide a practical business education to go with it. Then we'd see engineers who have some basic skills in business so they can grab managerial opportunities when they occur. The engineer who knows little about personnel management, accounting, investment banking, purchasing, marketing, salesmanship, public speaking, and so on, will usually avoid the better career opportunities that present themselves.

Take a subject such as advertising. As an expert in this, I'll let you in on a dirty secret. You'd be astounded at how few advertising professionals have any real background. Many of them are absolute frauds, making up for their lack of education with firmly held opinions. When you consider that virtually every firm needs advertising, it's amazing to me that there are so few courses available. I took an invaluable course at the Advertising Club of New York . . . one of the most valuable courses I've ever taken.

Almost anyone could become an expert in advertising in a few months just by reading a few books and taking a course. I'll bet you could run circles around 50% of the ad agencies in results, too . . . maybe 90%.

It's getting a bit difficult to become a computer expert now, but things are still wide open in most communications fields. I don't think there is a college teaching HF rf circuits anymore. They're teaching digital and microwaves. I'm not sure they're even teaching VHF and UHF circuit design.

Another frontier lies in getting stuff through the twisted pair. They're coming from 300 baud to 1200 . . . with 2400 moving up. But there are some sneaky ways of cramming 9600 baud on the lines. And we're hearing about 56,000! How much do you know about all this? If we can get that stuff through an ordinary phone line, how about putting it through a ham channel?

You've been reading a bit about spread-spectrum communications, but I'll bet you'd fall all over yourself if you were asked to explain it to your ham club. Well? Yes, I know it takes more effort than hoisting a cold 807. Maybe you find it more fun to get woozy with a few beers than to learn things. I've always found understanding something new to be exciting. I'll tell you what, the next time you see me at a hamfest or a club meeting, let's see if you can find a subject I'm unable to handle. I've got plenty of weak points . . . can you find 'em?

Another new technology that is working well for entrepreneurs is compact discs. You've probably read this is the fastest-growing consumer-electronic field in history. I've been visiting CD-only stores around the country. Most of 'em have been started on a shoestring, yet most of them have

gotten into the black in four or five months. Not bad for a retail operation. If you're into music, you might want to look into starting a CD-only store. It could turn into a chain.

There are a great many opportunities for people with an electronics background to start businesses. When microcomputers started I talked many hams into getting into the business. Some have done exceptionally well. Of course, if you're not using your interest in amateur radio as a way to build your electronic education, you're blowing a wonderful opportunity.

You might read through this issue of *73* and mark any parts that you don't really understand. Swallow your pride and corner a more technically apt ham and see if he can help you. He'll be flattered. Have I explained a fundamental fact of life recently? The more you get people to do for you, the more they'll like you. And the more you do for them, the more they'll hate you. So don't be shy about asking for help...it's the best way to make friends.

Speaking of which, I need your help. You may have noticed that *QST* is a tad fatter than *73*. This is a terrible situation—one which needs to be fixed as soon as possible. This is a situation where you can help. The formula is simple...the more advertising a magazine has, the more pages of articles it can publish...or club and operating news in the case of *QST*. A magazine generally attracts advertising in proportion to the number of readers it has. So if you can get some friends to subscribe to *73*, we'll have more advertising...more articles and a much fatter magazine. I'd love to have it up around 250 or 300 pages a month...but that's entirely up to you. Who do you know who should be reading *73*? Get after 'em.

If you have a job where unions are protecting your job and keeping you from progressing... I've had my share of that destructiveness...you're all set for long-term failure. You could hardly ask for a more secure grasp on failure. When I was in Chicago for the Consumer Electronics Show, I saw a *Chicago Tribune* union on strike—something to do with fighting work-saving plans by management. I suppose some bright college kid is trying to get them to shift from hand-set type to a Linotype machine. Tsk.

Even if you are completely settled in with failure in your own life...and have inoculated your kids with your same work ethic... how about getting your grandchildren off the treadmill? Would it really upset you if they became successful? Of course they're going to do as you do, not as you say. You're the role model, like it or not.

My grandfather helped Citgo get going back 70 years ago. My father started the first transatlantic airline. Neither did these things working 40-hour weeks, so I had excellent role models. I backed up this hard work ethic with education. When I got interested in amateur radio, I joined the school ham club and learned everything I could from the other kids.

It was my interest in amateur radio that pushed me into an engineering college instead of a liberal arts one. It was amateur radio that got me into the Navy radio-technician program, where I got a first-rate technical background in just a few months.

For years I learned, built, and experimented. I helped pioneer NBFM...then was an early sideband...one of the first in RTTY...one of the first in repeaters. My family gave me a good start. Are you giving your kids or your grandchildren as good a start?

There are some good books on success. I enjoyed the one by Ray Kroc, the builder of McDonalds. The Napolean Hill book, *Think and Grow Rich*, is in paperback. It's also available on video cassette, audio cassettes, and so on. If you aim at success, in the long run your chances of reaching this goal are much better than depending entirely on luck. Failure can be ensured by constantly pursuing the temporarily expedient.

Any questions?

BUILDING YOUR CLUB

The strength...and the salvation...of amateur radio lies in our radio clubs. Buying a subscription to *QST* is not going to save our hobby. For that matter, even buying a subscription to *73* isn't going to save it...though it will tell me you are interested in working with me to save it.

The secret to a successful ham club is the same as the secret to a successful magazine...it's gotta be fun. Unless an awful lot of hams...well over 5,000 in the last couple of months...have been lying to me at hamfests, they were going to be dropping *73* before long because it was no longer fun to read. Well, you'll lose your members if your club isn't fun. It's as simple as that.

But how in heck can you make a ham club fun for a bunch of weirdos, all with different interests? We don't have one hobby, we've got dozens of 'em...and obviously there's no way to please everyone. Maybe, maybe not. But let's look at the positive side of it and get a move on.

Your Club Newsletter

This is the medium that can make or break a club. As the publisher of *73* I get to see hundreds of club newsletters. Some of 'em are awfully good...some are pathetic. They don't have to be slick four-color publications, you know. The main purpose of the club newsletter is to get the members to come to the next meeting...so tell 'em what fun they're going to have when they come. Tell 'em what's on the program. If there's going to be a short pre-meeting technical session to teach feedline theory, urge them to brush up on their radio by coming early. You might get the club program chairman to knock out an enthusiastic piece explaining what s/he's got in store for the next meeting.

Have you considered a buck newsletter flea-market column? For $1 you can list four or five lines of gear you have for sale. This beats the devil out of the several-month wait for a classified ad in *QST* to hit. I don't know how much you shop the ham magazine classifieds, but my experience has been that 90% of the stuff is long gone by the time the magazine with the ad finally comes out. Once you're through with a piece of ham gear, don't put it up on a shelf and forget it...get it moving to someone who will keep it busy, someone who will get enjoyment out of it. Never mind that you'll probably waste the money you get for it on nonessentials such as food or clothes for the kids.

If you have a ham store in your area, you might start talking with the owner about running a couple pages of ads in your newsletter. It won't cost him much, but that, along with the classified bucks, can make the newsletter fly by itself. How much should you charge? Well, I'd suggest around 10 cents per reader per page. Thus, a two-page ad spread might

Continued on page 104



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Ham Awards

Worked All States Award

by William V. R. Smith N6MQS

When you receive your first QSL in the mail, it's an exciting moment. It confirms contact with another ham. You begin to collect QSL cards and clear off wall space to display your cards.

Each day, you're excited about your new contacts. You start searching for new states. It doesn't take long until you want to contact all fifty.

Making contact with all fifty states is the first on-the-air goal for most radio amateurs. A high-power rig is not required; contact with all fifty states has been done by stations with only five Watts of power.

The first step is to get your paperwork organized. You'll need a list of all fifty states and a checklist for completed contacts which shows receipt of QSL cards. This list should be nearby when you're on the air. A U.S. map is useful to provide a visual aid, and each state can be circled as contact is made.

Making contact with each of the fifty states is only the first step. Most awards will require proof of contact. An operator in each state must send you a QSL card. There are three rules to follow to make certain you receive these cards: 1) You must send a QSL to get one, 2) Send a self-addressed, stamped envelope, and 3) Make contact with at least three stations in each state.

The attached WAS worksheet will simplify and organize your paperwork. It will also make the effort a lot more fun. Along with a list of all fifty states, the form contains room to log contact with three stations per state. Three contacts should insure receipt of at least one QSL card. Next to the state name is room for an 'X'. This will show that a card has been received and the state is complete.

Most "Work All States" awards have special endorsements. You may earn an endorsement for contacting all fifty state capitals, contact on one band, or contact only with YL operators. Most awards have several endorsements available: Review the award rules for a list of the endorsements. You can make photocopies of the worksheet and use a new sheet for each endorsement.

The U.S. map shown below will orient you to each state's location and its distance from your shack. The call sign areas are marked to help you identify a station's possible location from the call sign.

After you have completed the worksheet, it's time to apply for a "Work All States" award. Many nets and clubs have WAS awards available. The most popular WAS awards are presented by the American Radio Relay League (ARRL).

You may request an ARRL WAS award application by sending a self-addressed, stamped envelope to: ARRL WAS Award Manager • 225 Main Street • Newington CT 06111.

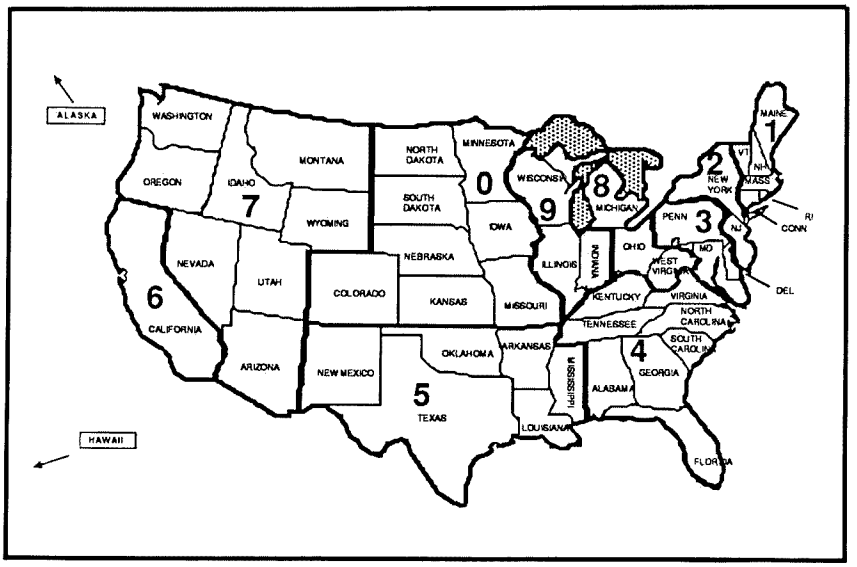
Along with the application, you'll receive a list of the many awards available and the special endorsements.

You will be required to fill out the application and sort your QSL cards alphabetically by state. The application and cards must then be mailed to the awards manager for verification. If you want the cards returned, you must enclose sufficent postage for their return (approximately two dollars).

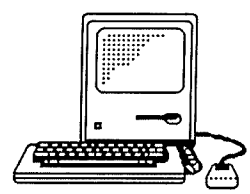
When everything checks out, you will receive a handsome WAS award in the mail. The award is shipped in a protective package to save it from the postal machines. The award will include your WAS number. This can be placed on your QSL cards. You have earned the award, so show off a little!

It took me almost four months to work all fifty states. In the process, I received over two hundred QSL cards from fifty states and thirty-five countries. I'm now working on state capitals and DXCC.

73 to you and yours. Good luck with "WAS," and I hope you tune in next month. N6MQS



U.S. map showing fifty states with all ten call sign areas. Circle each state as QSL cards are received. Alaska is in the seventh call area. Hawaii is in the sixth call area.



The award form presented here was designed on an Apple Macintosh by N6MQS and printed on a Laser printer.

NK6K > PACKET

Harold Price NK6K
1211 Ford Avenue
Redondo Beach CA 90278

It struck me the other day that people not on packet wouldn't know where the title of this column came from. On packet, when you're just monitoring the channel, your TNC tells you who each packet came from, and who it's going to. If NK6K were sending packets to a station called PACKET, each packet would be displayed with NK6K>PACKET: in front of it. That's all there is to it!

PACKET IN OTHER LANDS

A more or less regular feature here for the months to come will be a review of worldwide packet activities. Hams in other countries have a different perspective, and operate under different rules. The questions I've asked packeteers in other countries are:

1) How many packet users are there?

2) What packet standard is in use?

3) What frequencies are in use?

4) Are there any regulatory restrictions on the use of packet?

If you don't see your country mentioned, feel free to send in the answers. This column was written on May 28, and most of the DX comments were received earlier in the month.

Japan

These comments were received on CompuServe from Toshi JG1REA:

"The exact number of packet users is unknown but growing fast. AX.25 is used in almost all cases. The UHF band is most commonly used; frequencies around Tokyo are 430.98, 431.0, 434.0, and 434.44 MHz (430.98 is the most active). The 1.2-GHz band is in use around Osaka. Many Americans are applying for the new reciprocal licenses. 7J1AAA (AH0A) operates a PBBS in Tokyo."

In conversations with other JA and U.S. hams, many have noted that packet growth in Japan has been slower than might have been expected given the high interest in computers there. One possible reason suggested was that the general crowding of the VHF and UHF bands made it hard for a new mode to "clear space." Also, since the TNCs and software were developed in the United States, initial Japanese participation was limited to those who could work well in English. Early difficulties with TNC software in passing 8-bit data made it hard to send the various Japanese extended character sets through the TNCs. These problems have been largely overcome, and the packet transponder aboard the JAS-1 satellite should spur further interest.

South Africa

These comments were received on Telemail from Hans van de Groenendaal ZS6AKV, President of Southern African AMSAT:

"Packet radio first came to South Africa when Gordon Hardman ZS1FE/KE3D returned to Cape Town after the launch of OSCAR 10. He brought two TAPR Beta units which were extensively demonstrated at a SA AMSAT Satellite Communication Conference.

"After the launch of TNC-1 by TAPR, some 30 units found their way to the Johannesburg/Pretoria area. This was further boosted by TNC-2 and various models of the GLB units. Now the AEA Pakratt and PK-80 are further stimulating the packet revolution.

"In 1985 the first digipeater, ZS6LAN, was set up in the Johannesburg area, followed by a packet-radio bulletin board in Pretoria. Unfortunately, earlier this year lightning struck and blew up the bulletin board system. It was expected that a new system using the WA7MBL software and IBM-compatible hardware would become operational in June/July 1986.

"One of the first TAPR Beta systems is now used at the Johannesburg Amateur Radio Center.

"The total number of packet-radio stations in South Africa is estimated to be around 100, with the major activity centered around Johannesburg/Pretoria, Durban, Port Elizabeth, and Cape Town.

"The general operating frequency is 144.675 MHz.

"Plans for this year include setting up a digipeater system to connect Durban and Johannesburg/Pretoria."

United Kingdom

The U.K. has gotten off to a slow start mainly due to regulatory issues. Repeaters are tightly controlled by the Department of Trade and Industry and by the RSGB; currently, digipeaters are not allowed. The following comments came via the Uo-11 Digital Communications Experiment from Jeff Ward G0/K8KA, a temporary resident of the U.K. who is working on an advanced degree at the University of Surrey. He says that this is his understanding of the situation. The matter is still under review by the RSGB and the DTI, and neither body has made any firm policy statements on the matter yet.

"Activity: approximately 200 stations are equipped for AX.25. Centers of activity are in the London area, the Southwest (Devon and Cornwall), and East Anglia. The local activity is on 2 meters, with no generally agreed upon frequency at this time.

"In the near future, RSGB is expecting permission from the Department of Trade and Industry for a number of packet-radio repeaters on 2 meters. The frequencies 144.650 and 145.275 will be occupied by this network until the end of 1987, when UHF or microwave frequencies for packet will be identified. The 2-meter frequencies are being used in the short term, because most of the people interested in getting on packet radio will already have 2-meter capability, and the RSGB does not wish to force people to buy both packet-radio equipment and new rf equipment to enter the packet network. The 2-meter band is very crowded in IARU Region 1, however, and so, as packet activity increases, the network MUST move to higher frequencies.

"The current working definition of 'packet-radio repeater' is any store-and-forward device, which includes digipeaters, PBBS systems, and any higher level network relay device. Digipeating by individual stations is not legal, and will not be legal in the early stages of packet-radio implementation in the U.K. All repeaters in the U.K. must be separately licensed. One-to-many messages (bulletins, newsletters, messages to ALL) come under the definition of broadcasting, and will not be allowed initially, either. In the second phase of regulatory investigation, it is hoped that the DTI will allow limited bulletin-type messaging (at least by official bodies already generating bulletins) and reconsider the third-party-traffic clauses. RSGB hopes that amateur-to-amateur-via-amateur traffic will be exempt from third-party clauses.

"The DTI blessing for packet repeaters is expected to be granted quite soon, and while it usually takes several months to get a repeater license in the U.K., a few packet-radio repeater licenses may be sped through the process, resulting in an operational network by midsummer."

The initial close regulation may work to the advantage of network planners in England. The U.S. network has grown in a slightly topsy-turvy manner as various methods were tried, expanded, or discarded. The U.K. hams now have that base of experience to work with, and they can start out with a second-generation system, taking the best of what is available

DIN Connector		Mini-Plug	Sub-Mini-Plug
pin 1	(use center of shielded cable) (put 2.2-uF tant. in series)	middle sleeve	
pin 3	(same cable as above-use) (shield . . .)	big (top) sleeve (tip is unused)	
pin 4	(second piece of shield cable-use center)		tip
pin 2	(big center lug-use shield from pin 4 cable)		sleeve

Table 1. Wiring a Kenwood TH-21/31/41 for packet operation with a TNC-2/200/2A.

and developing new systems without having to maintain backwards compatibility with older installed systems.

Network Statistics

We need some. Most of our current metrics on network performance are subjective, i.e., based on perceptions of performance, as in "The path up north was really useless last night." While user happiness is one of the prime goals when tuning a network, best results are gained with a more quantitative measurement. If you're looking for something to do, how about implementing some network analysis tools? We're so bad off now, almost anything you'd do would be a vast improvement. Here are some questions we need answers to:

- What is the average size of a packet?
- What is the average number of digipeater calls in a packet?
- Which callsigns originate the most packets?
- Which callsigns receive the most packets?
- How many unique callsigns appear on the frequency each interval?
- What is the average number of retries?
- What is the average number of simultaneous active connections on the frequency?
- Which digipeaters receive the most use?
- For mailboxes, what is the split between local messages and messages destined for other systems? What is the split between personal messages and to-ALL messages? What is the distribution of file sizes normally seen on the network?

All of this needs to be broken out by various time intervals and plotted by time of day/week/month, etc. Each local area will be different.

The performance of the next round of networking software can be affected by all of these parameters. The network will also be more complex and have even more "tuning knobs." If we can't tell how well the network is running at time T, how will we know if we've improved it at time T1?

Just to put you in the numbers mood, here's a statistic we do have. The *NEPRA PacketEar*, the newsletter of the New England Packet Radio Association, keeps track of total message counts for 24 BBS systems in the New England area using figures gathered by WØRLI. They report a total of 5171 messages handled in the period 4/12/86 through 4/28/86. For this number, a message is counted each time it passes through a BBS, so if one message were forwarded 13 times in New England, the count would be increased by 13. While there were not 5171 unique messages, the BBS systems did pass messages 5171 times between them. How many unique messages were there? Someone should write a program to figure that out.

Speaking of things to do, here is a list of other things that haven't been done, or things that have been done but haven't been written up, which might as well be the same thing.

- SSTV through packet—I know that some graphics files have been sent, but has anybody taken a camera and digitizer, hooked them up to packet, and let them rip?
- Voice through packet—There are fancy ways to do this, and then there are brute force methods. If someone comes up with a simple audio-to-bits and back-again circuit, I'll send your audio file up to UoSAT-OSCAR-11, we'll get it downloaded and played out in England, and you'll be in the record books for the first amateur transatlantic store-and-forward voice-gram. You can get a lot of "Hello, OM" into 96K of memory. Even with a simple 6-kHz, 8-bit A-to-D, you can get 16 seconds of message sent. Squeeze the file, and you'd get 25 to 30 seconds. Get fancy, and get more. Any takers?
- Packet above 440 MHz—TAPR and AMSAT ran packet between their booths at Dayton one year on a pair of loaned ICOM 1.2-GHz rigs. Is anyone doing it on a regular basis outside of Japan? Anyone taken a pair of 10-GHz Gunnplexers and pushed packets through them?
- Network map standard—There are several different "network maps" around, from the pin-and-yarn map seen at conventions to the multi-K-byte EASTNET map. All of them are hard to read, and all are hard to update and integrate. Anyone have a good idea how to print a network map?
- Network user database—I know I want to send mail to VE3GYQ, but I don't know which BBS he gets his mail from. Short of calling him up and asking, which takes all the fun out of it, how do I find out? If he has a BBS, how do I know which BBS routes mail to him? I've seen several attempts to start local, regional, and national directories, and there are at least three ongoing in southern California now. Anyone have an idea on how to make the updating job easy, and how to share data across local network boundaries?

We've got a lot to do, and if the trend of the age of the average ham increasing one year per year continues, we don't have much time left to do it in. (On the other hand, counting users would get easier every year!)

Kenwood TH-21

Several people have asked for information on how to hook up a TNC to the Kenwood shirt-pocket radios. I put out a call for help, and got the information from the Radio Amateur Telecommunications Society (RATS). Their address is 206 North Vivyen Street, Bergenfield NJ 07621, should you be in their area and want to join. Table 1 gives the details.

That's it for this month.■

FUN!

John Edwards KI2U
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ASPIRATIONS

When you're young, you have aspirations.

Most young men and women have very normal goals in life. Some kids want to work hard and become captains of industry, others dedicate their lives to science, and a few look for an easy way out and pledge their lives to politics.

As a teenager, I also had goals, one of which included becoming a repeater owner.

Ah, repeater ownership—there's the life. A repeater of your own. No one telling you that you're hogging the machine, reminding you to leave a pause between transmissions, or hounding you for membership dues. You're the boss, number one, numero uno, head honcho. The Big Cheese.

When you're 22, as I was in 1976, those are powerful thoughts. When you're 22, a dyed-in-the-wool ham, a B student at a commuter college on Long Island, and someone with no aim in life, repeater ownership is nothing less than an aphrodisiac.

So one fine spring evening in 1976 I asked my friend, Jon WA2MJK, if he was interested in launching a repeater.

"A repeater?" he said, looking at me as If I had asked him to join me on a DXpedition to Venus. "They cost money!"

Jon always was sort of practical.

"Sure they cost money," I replied. "But if we build one from a kit, we can save a lot of dough." I then hauled out a copy of *73*, and showed Jon an ad from a company in Binghamton, New York, that sold repeater kits.

Jon looked at the ad, then raised his eyes toward me in a most skeptical fashion. "John," he said, "the only kit you ever built was a Heathkit Sixer and, if I recall correctly, that never worked right because you left six-inch-long leads on all of the resistors.

"I know," I replied, "but that was 1969. I'm an Advanced now. I know better."

So the discussion continued for the rest of the evening, with Jon pointing out the headaches of repeater ownership while I spun a tale of glory and power. In the end I won. I had Jon wrapped around my little finger.

The next several weeks passed quickly. There was equipment to build, frequencies to acquire, FCC applications to fill out, antennas to erect, and spirits to sag.

The first assault on our hopes came from the ARRL frequency coordinator, who we cornered at a meeting of the local repeater council. The coordinator responded to our request for a 2-meter channel pair with the same bemused attitude a loan shark exudes when asked for extra time on a loan. First he laughed, then his nostrils flared in a most nasty way.

"A 2-meter pair? I got loads of them. They're in my pockets. Look, see," he said, turning his trouser pockets inside out.

Feeling a length of RG-8/U tighten around my gut, I croaked out, "How about 450?" figuring that UHF was better than nothing.

"Look, kid, you want a repeater,

go use one. New York is the repeater capital of the western world. We got repeaters here that haven't had a human voice on them since Maxim invented coffee. We're talking about an underutilized resource, pal."

The repeater coordinator was tiffed. Jon started sniffling. I felt sick.

Then, I don't know what it was. Pity, I think. Jon and I were looking fairly pathetic, which was a typical state of affairs for the two of us.

The coordinator glowered, raised his eyes heavenward, and said: "Look, guys. I know you fellas are never going to get a machine up anyway, and I got a pair of 220 frequencies. Some club up in Westchester was supposed to use 'em, but they never got their act together, either. They're yours for a year. Get a machine up and they're yours forever. In a year, maybe that Westchester bunch will be ready to go."

Two-twenty. Yoweee. We were in business.

"The next step," said Jon, alternately sucking down a beer and puffing on a Salem in the mature manner that only a recent graduate of Youngstown State University could muster, "is to build the machine." He was right.

So we ordered the repeater kit from that company in beautiful Binghamton, New York. Another *73* ad had won another customer. The kit, when it arrived, was beautiful.

"Look here! It's a chassis!" shouted Jon, his eyes aglow, as his fingers clawed into the massive crate.

"To hell with the chassis," I yelled. "I got the reset button!"

Immediately, we began dividing up the parts packs. I made the assignments.

"The receiver's for you, the transmitter's for me, the carrier-operated relay's for you, the IDer's for me." Already the power was rushing to my head.

The work went quickly, the repairs went slowly.

"Worst damn soldering job I've ever seen," said the tech in Binghamton on our second visit to that fair city on the shores of the Susquehanna. (The first trip back to Binghamton had failed to sort out our repeater's problems. It's funny how little cold solder joints can have such a major effect at 220 MHz.)

"Heh-heh," I chuckled, in my best Edward Arnold-style insincere laugh. "You know how little brothers are," referring to my blessedly innocent sibling, Jim WB2LWJ. "Last time I let my damn kid brother work on a circuit for me," I said.

Some folks have claimed I have a bit of the pathological liar in me. Nevertheless, with the now-repaired machine, I was the chief control operator of what I knew would become the Big Apple's premier 220 repeater.

Of course, being the chief control operator of a New York 220 repeater, at least in the 1970s, was a bit like being king of the North Pole—your kingdom had plenty of land coverage, but few subjects. But that fact was still unknown to two innocent hams.

Standing in my parents' basement, a Station Master perched on the roof, Jon and I jointly flicked the Master Control Switch. A red pilot light glowed, a hiss spilled out of the repeater's speaker, and the transmitter tripped. I expertly adjusted the squelch knob until the hiss disappeared and the transmitter unkeyed. But as I was doing this, the IDer kicked in: Dit dah dah, dit dah dit, dit dit.... WR2APG was open to the world. A salty tear rolled down my pudgy little cheek. A tingle went up my spine. I had reached the pinnacle. I had peaked. The only way left was down.

The next few weeks went slowly. "Silently" might be a better word. Precious few souls visited WR2APG, the pride of Glendale. Occasionally, a passing mobiler would stumble across the frequency, give a call, and then, after getting a 25-minute greeting speech from Jon, rapidly move on.

For six long weeks, we had three regular users: Jon, myself, and Pierre, a retired prison guard who lived in Manhattan. Pierre was the only other person we knew who actually owned a 220 rig. We used to steal him away from the NBC repeater for QSOs.

At night, I would lie in bed listening to the COR thump, the sound grumbling up through the floor. Occasionally, I would hear Jon's muffled voice say, "WA2MJK listening, WR2APG." Sometimes, I would hear Jon kerchunk the machine. I knew it was Jon because Pierre went to bed early. On the whole, generally speaking, it was pathetic.

Things got worse. A storm knocked the Station Master over. We fixed it. A taxi company caused intermod. We fixed them. Then Jon, who was in advertising, got a job offer from a midwestern firm that was a direct-mail record manufacturer. "The 101 Collected Hits of Allen Ludden" was their big hit. You may have seen the commercial on TV. The company also repackaged classic movies with modern personalities. Remember "Oy! A Yankee Doodle Dandy!" starring Myron T. Cohan?

Without Jon's 50-percent financial support, WR2APG couldn't go on. After all, a $10 a week allowance can only carry a repeater so far. New York's premier unused 220 repeater was heading for bankruptcy.

So we sold our beloved machine to a group of guys who already operated a wildly successful 2-meter repeater. They said they were going to place our baby, built with our own hands and rebuilt by the tech from Binghamton, on top of the Empire State Building. Show-offs, right?

Well, they did it. Within two-and-a-half weeks the guys from 2 meters were up there running autopatches, crosslinking over to 10 meters, setting 220 DX records, holding Dean Martin celebrity roasts for ARRL officials, and having a grand time. I would listen at night, holding my HT on my lap. The IDer sounded so familiar, the callsign so foreign. In 1979, short for cash, I sold my 220 rig. I haven't been back on the band since.

Not so long ago, Jon moved back to New York. The record company went belly-up after it diversified by marketing Rod Carew snowshoes. The infamous Mild Winter of 1985 caused the firm's frozen assets to melt.

Sometimes, when the moon is full and our heads are empty, we reminisce about old WR2APG. The times we almost had, the people we didn't meet. The power I wanted to wield.

One recent night, Jon recalled an incident of 220 repeater lore.

"Remember the time you hollered at the FCC representative because he announced they were discontinuing 'WR' prefixes?" Jon said.

"That was at the '77 ARRL New England Division Convention up in Hartford, wasn't it?" I replied.

"Indeed," said Jon. "If that fellow was a member of the radio police, he would have taken you from Hartford to Danbury and thrown you in the federal pen."

"I got kind of attached to WR2APG," I said.

"Bad manners. Bad form," said Jon.

"Aw, damn," said I.

"That was the mildest epithet you used," said Jon.

The other day, I asked Jon if he was interested in starting a computer bulletin board.■

RTTY LOOP

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My faithful readers will have noticed that last month's *73* was devoted to the phenomenon known as packet. I have covered packet in various aspects in the past year or so, and today I have a different way of looking at the subject. Let's have a look at some packets you all have sent me, in the mail, of course! (Well, somebody has to be an individual!)

Several times in the past few years I have mentioned a RTTY program for the Apple computers that I knew only as the "Galfo" program, and I have repeatedly asked for information on it from all of you. Well, this month, several of you have dropped me a bit of information. Al Sines WA3QGA in Laurel, Maryland, tells me that he has the version of the program supplied by AEA (Advanced Electronics Applications) with his CP-1 interface. He relates that it works with all versions of the Apple II series up to, but not including, the Apple lie.

John Donohue AB7M of Seattle adds a little more information. He tells us that the program was written by Dr. H. Christopher Galfo WB4JMD in 1978. It requires Integer Basic, and to run it on other than the Apple II requires an Integer card or a RAM card in slot 1 so that the Integer Basic may be loaded from disk.

Operation on Baudot (Murray), ASCII, and CW is available. Bau-

dot and ASCII speeds are from 32 to 300 baud; CW can be run between 2 and 125 words per minute. CW receiving speed is adjustable by the program from 1/3 to 3 times the selected speed.

AEA, Inc. (PO Box C-2160, Lynnwood WA 98036) has this program available as "CP-1/Apple-1." The price, according to John, is $29.95. He says that the program is furnished on a DOS-3.3 disk together with a connecting cable to run between AEA's CP-1 modem and the Apple II's 16-pin DIP game port.

John adds that operation of the Galfo program is easy enough, although a newcomer to RTTY may have to study the documentation from time to time until he is at ease with all the features. The only problem he has had with it is that the function which provides for storing a message for later transmission seems to be limited to about 250 bytes.

Thanks for the information, fellows, and I am sure that Apple owners appreciate the guidance.

Okay, folks, now listen up. Earl Morris N8ERO passes along the news that as of this writing (end of May) he has a Model 15 Teletype machine offer to anyone who would like it. Assuming it is still available, contact him at 3200 Washington, Midland MI 48640.

Newcomers are always welcome to RTTY Loop, and I have a letter here from Gary Halbe N3EMY in Willowgrove, Pennsylvania. Gary says that he is a "relatively new ham and very excited but confused at the same time. There seem to be many, many directions in which to go, and it's quite difficult with limited time and finances to do it all. However, I do enjoy the digital communications aspect quite a bit. I have enjoyed computers for some time. In fact, that is partially what got me into amateur radio. Anyway, not to digress too much, I also read your monthly RTTY Loop column and find it very interesting and informative even though I do not have a RTTY setup at this time. I do hope to set up a RTTY station shortly, though, and at work they were discarding what appeared to be a fairly new Teletype machine. As I have several computers in the house, I took the opportunity to get a free printer. As it turns out, this machine did not print what it was supposed to be printing. I searched around for model numbers, etc., and found several bits of info.... The manufacturer is Siemens. I phoned them to see if they could shed any light on why I could not properly connect this to my computers. The person I spoke with informed me that the reason was my computers were using ASCII and the Teletype was using Baudot. Now my question to you is did I find myself an inexpensive piece of gear I can use on RTTY, and if so, where can I find more info on what I need for interfacing, programming, etc.? Just a little more info which may be helpful in your determination is that this Teletype has the tape punch and reader. I believe it was hooked up to a phone line, and it has three wires, send (+), rec (−), and gnd.

"I wish I could give you more info such as a model number or whatever, but at the moment I can't. If the info I did give is enough, please let me know what to do with it and/or how to do it. Hopefully, it will all work out and sometime in the near future I will be on the air. If it is useless and I have some piece of worthless space-eater, let me know so I can lug it out of the shack and have some room again."

Hoo boy, Gary! Siemens is a German manufacturer that has built quite a variety of devices, from the teleprinter you describe to the electrocardiograph machine in my office. Even a picture would be helpful to try to figure out just what you have. Even better, if there are any RTTY-o-active hams in Gary's vicinity, why not give him a call and see if a hands-on session doesn't do the trick. Let me know what happens, Gary.

Timex/Sinclair folks, your turn! Don Cain NJ6Z of Los Angeles has used the NARP program for the Timex/Sinclair ZX-81 for receive, and feels it worked well. He passes along the information that NARP also uses a terminal unit designed by the author of the software, Cliff Nunnery NU4V of Fort Walton Beach, Florida. Sounds good, Don, and thanks for the information.



Maryland recognizes hams.

On the other hand, Gregory McKenna VE2AGY of Chateaugay, New York, owns a Timex 1000 computer and would like to put his machine on RTTY, too! Anybody? I have searched my files, such as they are, and have turned up nothing on the 1000. (I know, somebody is going to send me an old column where I mentioned the thing. I never said I was organized!) Anyway, let me hear from you if you are using a Timex 1000 on RTTY, and I will publish the information for all to benefit.

Phillip H. Creasy, Jr. KC3FG of Hermitage, Pennsylvania, says that he would be interested in a RTTY program for the CoCo that would access disk to send, receive, or keyboard buffer for storage, and spool off to a printer at 1200 baud for autostart RTTY. At least, Phil! Why stop there? Seriously, though, the wish list is well received. Now, I am not normally one to spread rumors, but I have it from several reasonably reliable sources that there are a few CoCo RTTY—as well as other modes—programs soon to be announced—right here, if we're lucky! So, stay tuned. I will not hold onto this information one issue longer than necessary.

Winner of the "voice from the past" award for this month is Tom Kennedy K8TK of Clark Lake, Michigan. Tom is another one interested in the ancient 6800 microprocessor which, he says, "still appears on college campuses and seems to be one of the best processors to 'cut your teeth on.'" Thanks for the other good words in your letter, and a copy of the reprint list is on its way to you in the mail. That reprint list remains available for any of you, of course, for a self-addressed, stamped envelope sent to the address at the head of this column. I have put together a bunch of material from the early days of this column, updated and revised, which seemed to interest many of you. Feel free to send for the list and look it over. It'll only cost you a stamp—the list, that is.

I have mentioned a few items of interest to CoCo owners in the past, and here's another. Bob "Whiffle" Rosen, the ham whose Spectrum Projects cater to the needs of the CoCo computerist, advises me that he will offer a new keyboard to readers of RTTY Loop at less than half his usual price. The new keyboard, the type being supplied on new CoCos, drops right into all CoCo IIs, "F" boards, and TDP-100s. Normally selling for $39.95, it is being offered for $14.95. An adapter for D or E boards is also available, for $9.95. Add $3 shipping and handling for each keyboard, and send orders to Bob at PO Box 21272, Woodhaven New York 11421—be sure to ask for the RTTY Loop special. By the way, Bob adds that if you get a few folks together, six or more keyboards ordered at one time will drop the price to just ten bucks apiece! Thanks, Bob.

Another topic we have touched upon here in the past has been WEFAX. This facsimile transmission, frequently heard along the HF spectrum, is a potent source of information with weather maps, slow-scan TV signals, and the like. Well, just finding the signals has been a problem, a problem which Joerg Klingenfuss has addressed once again. His *Guide To Facsimile Stations* has just been published, and quite a work it is! Frequencies from VLF to UHF are covered, with more callsigns, pictures of test patterns, and assorted advice than you are likely to find in any other single source. There are even schedules of 94 FAX stations on 340 frequencies. This valuable tome sells for DM30 [2.27 Deutschmarks = $1 as of early June] and is available direct from Klingenfuss Publications, Hagenloher Str. 14, D-7400 Tuebingen, Federal Republic of Germany. Be sure to mention RTTY Loop if you write. Who knows, maybe one day I will work out a stateside distribution arrangement with them (Hoeren Sie, Joerg?).

In a couple of months, we will be looking at some of the items you all have found useful for RTTY in the annual shopping guide. How

about some nominations, folks? Drop me a line, either on paper or via E-mail, with your vote for the more useful RTTY items available, and, if you like, the klunker of the year. Try to get the information to me as soon as possible for inclusion in this year's guide.

Still very little curiosity out there about Green Keys! What if I tell you that they were NOT named for Wayne?

One closing note, the photo this month is of our new Maryland Amateur Radio Operator license plates. Aren't they nice? They even *say* "Amateur Radio Operator" on them, reflectorized, and everything! I just thought that those of you who still may be fighting for callsign tags might like to see these new designs. If anyone from our State Motor Vehicle Administration happens to be a ham reading this column, thanks!

More fascinating stuff on tap, with my promise to look at at least one thing that nobody else would look at. Of course, I look forward to your comments, as always, via the postal service or CompuServe (ppn 75036,2501), but now you can add Delphi to the list, username MARCWA3AJR. As long as I can afford the connect fees, I will try to stay on-line now and then.

Until next month, then, that's it for RTTY Loop!■

LOOKING WEST

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COORDINATION FEES or HOW MUCH AM I OFFERED FOR .16/.76?

Hams may soon find themselves paying for repeater coordination! The FCC says that no specific rules exist to preclude repeater frequency coordinators or councils from charging fees for coordinating, moving, or maintaining a repeater's coordinated status.

This information came to light in early May as the result of a meeting between opposing factions of Alabama repeater owners and FCC field personnel. The meeting was ostensibly to determine what two-meter band plan Alabama would follow and who would oversee future Alabama coordination efforts. Some of those in attendance favored the continuance of the existing Alabama Repeater Council plan, with its mandated imposition of the Pacific Northwest 20-kHz band plan in the 146–148-MHz subband allocation. Others said that 20 kHz was not working; that it caused interference to systems on 15-kHz centers in neighboring states. They said that the Alabama Repeater Council had acted unilaterally by forcing them onto 20 kHz. They were demanding a return to 15-kHz channel spacing and the dissolution of the new alliance with the CVRA Southeastern Repeater Association even though the CVRA had previously stated it wanted no part of Alabama until it straightened things out.

CVRA founder Wayne Williams K4MOB had told me that the CVRA was not going to walk in and attempt to solve the problems of another area, and he did not want his organization accused of pillaging another state simply to make itself even larger. Regardless of what some Alabama repeater owners were demanding, the CVRA maintained a hands-off, wait-and-see position.

And so it was to happen at this meeting in Birmingham on May 10 that officials from the FCC's Atlanta field office would be asked one key question: Was it possible for whomever would wind up coordinating repeaters in Alabama to collect a fee to offset the cost of performing frequency coordination and maintaining an accurate data base?

At that time, the FCC people could find no specific regulation that precluded the collection of fees. Wasn't there anything in the Part 97 rules to cover this? How about the regulations covering pecuniary interest on the part of hams, preventing them from receiving compensation for voluntary services rendered? Well, to make it brief, subsequent conversations between this reporter and various Washington FCC officers also failed to find anything specific to keep such fees from being imposed and collected by coordinators. Also, under the present regulations, there is no maximum limit on what such a fee might be.

While the regulations covering the VEC program that permit collection of a specific amount to reimburse VECs and VEs for their out-of-pocket expenses might be applicable here, unlike the VEC program, the costs involved in frequency coordination vary greatly between geographic regions. This is because of such variables as the number of hams served, the demand for repeaters on a given band, and the spectrum still available for new systems. Deriving a fee schedule for coordination and maintenance of coordination data for each geographic region might prove to be impossible.

For example, a single coordinator in a sparsely populated region such as Idaho might have negligible operating costs because he has relatively few repeaters to be concerned with, a fairly small amateur population, and plenty of room for new systems on every band from 10 meters up to light! On the other hand, the same job for a major coordination council serving a state like New York, Illinois, Texas, or California might find its costs running into the hundreds or even thousands of dollars to perform the same individual task for each new repeater or change demanded by an existing system.

If you set a single national fee based on the average costs to all councils combined, there will be some very wealthy coordinators in the hinterlands with little to do, while their city cousins are fighting to make ends meet. Or at least they'll be making that claim, since permitting fees to be collected for coordinating ham repeaters does immediately commercialize amateur relay operation one more step.

The Analysis

First, let me go on the record as violently opposing any coordinator or coordination council being permitted to collect anything for any work. We must remember that in speaking of coordination, we also have the word "voluntary." To me, that has always meant that *everyone* involved in the coordination process is performing on a voluntary basis. Unfortunately—at least in Alabama—there appear to be some who feel that the position of coordinator or coordination-council member should be a paid position, and that the person putting up a repeater should pay the costs. Well, what happens to the meaning of "voluntary" then? Half of it disappears. Also, without a maximum allowable fee, such coordination charges would be open to abuses by individuals or groups who might see in the situation an easy way to profit from such an undertaking.

To show you just how outlandish this could get, let's look at the all-volunteer testing program for a moment. You will notice that one publication, the *W5YI Report*, written by my friend Fred Maia, is accredited as a VEC in all testing districts. While the FCC hates the term, Fred is a de facto national VEC. With this as a precedent, why shouldn't *73* become a "Frequency Coordinator Accredited in all States and Coordination Districts"? Absurd? You bet, but I'll also bet that there will be some individual or group who will do just that if coordination fees are permitted.

Let's continue this stupid hypothesis for a few more paragraphs. Obviously, we must figure out a fee schedule that is based on "average" cost nationally. Well, turning to the various land-mobile service coordination groups, we note that the average is only a few thousand dollars per system. Since the cost to find a home for a ham repeater is not really any different in the amount of labor and time than finding a home for a land-mobile system, it's obvious that the same charges would be equitable. Right? So, since we obviously must charge based on a "national average" of costs involved, we find that $2,000 for initial coordination and $200 per year for maintenance of the data base is about right.

But wait! What about the coordinator or council already serving your area? The guys and gals who have been doing a good job, free of charge, for many, many years? Well, there is nothing to keep them from coordinating repeaters as well. In fact, if we again use the all-volunteer testing program as our guide, you note that there are the de facto national VECs such as the *W5YI Report*, the ARRL, Metroplex, and DeVry. There are also many regional VECs that serve only one specific call area, such as the Sunnyvale VEC, the Greater Los Angeles Amateur Group VEC, and the SANDRA

VEC. All serve only the 6th call district, which also happens to be the 6th testing district. So, the 6th district is served quite well by seven VECs!

Coordinationwise, California has four officially recognized repeater councils plus a few "splinter groups" as well. In the northern half of the state, the Northern Amateur Relay Council has been the main entity for a decade and a half. (Its authority to coordinate has recently been challenged by a group calling itself the Greater Pacific Coordination Council, which wants everything north of San Francisco and the area covered by the Central Valley Repeater Association. As the group's name implies, it wants jurisdiction over everything in the way of amateur relay stations operating off hilltops in California's Central Valley area.)

Then when you cross the Tehachapi Mountains, you get into Southern California, where 10 meters, 6 meters, 3/4 meters, and all bands above are the domain of the Southern California Repeater and Remote Base Association. Those are the fine fellows who absolutely refuse to publish a list of all activity on the UHF bands they coordinate because they consider everything and its uncle to be "private turf." Oh, they do list a smattering of supposedly "public-access" repeaters. (Does this mean that no license is required?) But what about the other 500–600 systems that pervade the Southern California UHF airwaves? Supposedly, they "do not exist" as far as the outside world is concerned.

Two meters and 1-1/4 meters each has its own coordination council, which operates on a by-band basis. Two meters is represented by the Two Meter Area Spectrum Management Association, while 1-1/4 meters is the domain of the 220 SMA. Unlike their UHF counterpart, neither of these groups is paranoid about letting the world know that these bands are utilized—in fact, very, very utilized. So much so, that it's virtually impossible to get a two-meter repeater channel pair anywhere in California—that is, from the current coordinators. (The South also has several splinter coordination groups, but like those in the North they have no meaningful public recognition. Three exist, all based on the demographic characteristics of their constituencies.)

Obviously, a good entrepreneur could really clean up in California! I can just picture the advertisements in all of the ham magazines:

California Hams!

Tired of waiting for a frequency for your new two-meter repeater? Tired of the NARC and TASMA runaround? The *73* Amateur Radio National Frequency Coordinator can get your repeater on the air. Send check or money order for $2,000 today. Frequencies now also available on every band for repeaters, remotes, digipeaters, and simpatches. We coordinate everything, everywhere if you will pay the fee!

Don't worry; you are not going to see this ad anywhere except in this hypothetical treatise. *73* is not about to get into repeater coordination! If it did, it would probably fall on my shoulders, and I have enough worries right now without taking on national frequency "speculation."

While we are on a roll, let's keep on going. Why just coordinate repeaters, remotes, and other relay systems? While we are at it, how about the low bands? Think of the bucks that could be made by forcing your coordination onto all of those 75-meter rag-chews and nets. How about selling discrete operating frequencies to DXpeditions, or better yet, to those multi-multis trying to make the contact from stateside? It's well-known that the DX crowd is the wealthiest part of ham radiodom. How much is a clear spot on the low end of 20 meters worth? Would someone pay $20,000, or maybe even $50,000 or more? And all those wealthy yachtsmen on 14.313 MHz busy conning naive stateside hams into breaking Part 97 rules by making business calls and business autopatches for them. . . well, if they can afford a $2,000,000 yacht and a $2,000 top-of-the-line radio, how about a "coordination fee" to them of say. . . $1,000 a year. If any hams can afford such a coordination fee, they can!

And we must not forget our ham satellites. If fees are "in order and legal," then why not permit AMSAT to "coordinate" everyone who uses one of the OSCAR birds? Currently, the cost of commercial time on a communications satellite such as Galaxy or Telstar is about $750 an hour, not counting the uplink and downlink facilities. Since we hams have our own uplinks and downlinks, we need to consider only satellite transponder time. Now, what true-blue, died-in-the-wool satellite fancier would not be willing to pay that pittance to AMSAT for the privilege of having his or her signal heard throughout the footprint of an OSCAR bird? And what a boon to AMSAT if they had several hundred thousand dollars a month coming into their coffers. New satellites would be going up on a regular basis. They could even have companies like RCA or Hughes build them!

The possibilities opened by the FCC permitting the collection of coordination fees are endless! You need only search your imagination to quickly become the richest ham in town.

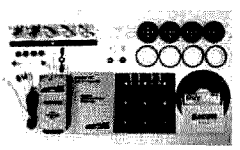
So, while fees may seem innocent enough on the surface, they are far from that. In fact, I feel that permitting coordinators and councils to collect fees of any sort is to invite the kinds of problems that we hams are ill-prepared to cope with. I have nothing against repeater councils charging membership dues to those who wish to join such a group, as long as membership is on a voluntary basis. In fact, that has been a tradition down through the ages with any club or organization. There is a difference between charging an annual fee to those who wish voluntarily to join an organization and forcing someone to pay a specific fee for a service rendered. Coordinators and councils do not now sell frequencies, but given the legal right to collect fees for performing the coordination process, they soon would.

In Alabama, a $10 fee for initial coordination and $5 for any changes was proposed. Whether this fee will ever be initiated in the state is unknown. Also unknown is whether the FCC will act to close this loophole in its regulations to prevent the imposition of such fees by coordinators or coordination councils. As stated earlier, I oppose the collection of fees by frequency coordinators. In two decades of operation, the concept of voluntary coordination has worked because those involved were individually and collectively dedicated to preserving a sense of sanity on our VHF and UHF bands. Institution of fees will only commercialize amateur radio further and make buying a repeater channel pair as easy as buying a prefabricated repeater system itself. Is that what ham radio is all about?■

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↙84

73 INTERNATIONAL

Just because I started this column as a result of visiting DX hams is no reason you shouldn't put in your 2¢ worth and let me know what DX news you find most interesting. My inclination is to have DX ops tell us what they think is interesting—how we can get permission to operate if we're fortunate enough to visit—any coming DXpeditions—what's doing with repeaters—things like that. What do YOU find most interesting? Since we have a world hobby, I think you'll be as interested as I in what is going on. If nothing else, it gives us something to talk about on the air which, from what I'm hearing these days, can't hurt.

—Wayne.



BAHRAIN

Ian Cable A92BW
Amateur Radio Association Bahrain
PO Box 22381
Muharraq
Bahrain
Arabian Gulf

Welcome back to 73 International, Bahrain and A92BW, last seen in this column in June, 1983! We may expect to hear more from ARAB (Amateur Radio Association Bahrain) when something more happens, whenever that might be. As the following shows, it cannot be predicted with any accuracy.

Not much is happening in Bahrain. Some DX gets worked but there are no thoughts of DX operations. The 2m repeater functions on R6 European band plan and enjoys a small and somewhat infrequent following.

Visiting hams are welcome to contact ARAB for information, and we are also listed in the local telephone directory, yellow pages. There is absolutely *no chance* of visitors obtaining a license or even of operating from an already established station here.

We have had a QSL bureau here for the past 30 years—operating out of my personal mailbox for 25 of them. Third-party traffic is not permitted, and there are no special-activity prefixes likely to be aired for the balance of 1986. There is some activity via OSCAR 10 mode B and also HF band AMTOR.

The number of amateurs in Bahrain is smaller than it used to be as the expatriate population has fallen—there is a recession out here, too—but there is a growing awareness of the amateur radio hobby amongst the Bahrainis themselves, which is most welcome.



ECUADOR

Alberto Henriques Navarro HC2HX
President, Guayaquil Radio Club
PO Box 5757
Guayaquil
Ecuador

MIDDLE OF THE WORLD

The first annual "Concurso International DX-HC Mitad del Mundo DX-HC" (International DX-HC Middle of the World Contest) has been announced by its sponsor, the GRC (Guayaquil Radio Club), for the purpose of strengthening "the friendship between the HC and the rest of the world's ham radio operators."

"El Ecuador abraza al mundo y el mundo al Ecuador," the announcement reads—Ecuador embraces the world, and the world embraces Ecuador. The contest will run for 48 continuous hours from 0000 UTC October 4 until 2359 UTC October 5—the first weekend in October will continue to be the days scheduled for this contest.

All amateurs are eligible to enter except the special HD stations and members of the GRC contest commission. Frequency: SSB, with the maximum power authorized for the ham's own station license. Call: "CQ HC Contest." Exchange: RS plus three digits (e.g., 59-001 to 59-999). Entry classes: single operator, 7-MHz band; single op, 14-MHz band; single op, both bands; and multi-op, both bands. Contacts on crossband are not permitted, and transmitting two or more signals at the same time, including cases of different bands, is not allowed.

Special Middle-of-the-World callsign stations: HD1GRC on the equator; HDØGRC, the Cayambe Volcano; HD7GRC in the Ecuadorian Amazon; and HD8GRC on Galapagos Island. Contact with these is worth 20 points for both HC and non-HC stations. Non-HC station contacts with HC stations are worth 10 points as are HC contacts with non-HC stations. Non-HC multipliers: the sum of the numerals of worked HC zones (only once and per band), so that the maximum multiplier for 7 MHz is 36, as is the maximum also for 14 MHz, since 1+2+3+4+5+6+7+8=36.

HC zones are:

HC1—Carchi, Imbabura, Pichincha
HC2—Guayas, Los Rios
HC3—El Oro, Loja
HC4—Manabi, Esmeraidas
HC5—Chimborazo, Canar, Azuay
HC6—Cotopaxi, Tungurahua, Bolivar
HC7—Ecuadorian Amazon
HC8—Galapagos Island

HC contacts with HC stations are worth 5 points; HC multiplier is the number of countries worked, according to the ARRL list. Only one contact per station per band can be counted. Total score is the sum of the contact points on each band times the multiplier for that band.

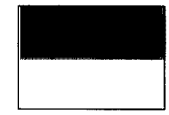
Summary sheet: Write in your declaration and signature to give evidence of following the contest rules; include callsign, full name, entry class, type of license, and address. Log sheets (separate logs for each band): band worked, date, UTC time of contact, call of station worked, signal report given and received, and summary of points and multiplier.

Summary and logs should be postmarked by December 31, 1986, and mailed with five IRCs to International DX-HC Middle of the World Contest, c/o Contest Manager, Guayaquil Radio Club, PO Box 5757, Guayaquil, Ecuador, South America.

A trophy and diploma will be awarded to non-HC first- and second-place winners in each entry category (a medal and diploma for each HC first- and second-place winner). Only one prize per station. Awards will be made to non-HC stations with more than 30 QSOs with HC stations and 3 or more with HD stations, and to HC stations with more than 60 QSOs, of which at least 30 must be with non-HC stations—and additionally for 7 MHz, there must have been contact with 3 HD stations, and for 14 MHz, with 1 HD station. There will be special WHC (worked all HC) certificates for every station participating in the contest that contacted at least 5 HC zones.

Disqualification: For violation of contest rules; for violation of country-of-origin rules for radio amateurs; for false statement in a report; and for duplicated claim credit on any one band in excess of 5% of the total.

NOTE: First prizes in non-HC categories will be melted granite medallions—reproductions of the "Jama Quaque culture" from Ecuador's Manabi province around 1500-2000 B.C., sculpted by Paul Palacios.



INDONESIA

Erlangga Suryadarma YBØBZZ/V85BZ
ORARI National QSL Bureau
PO Box 96
Jakarta 10002
Indonesia

(Continuation of last month's report by YBØBZZ and Ben S. Samsu YBØEBS.)

As announced at the IARU Region III conference in New Zealand last November, ORARI (Organisasi Amatir Radio Indonesia) now has these plans:

1) To establish better organization throughout the country for the ORARI QSL and Awards Bureaus.

2) To establish a better and continuous publication of periodicals, magazines, and other printed material for members.

3) To establish training sessions for the promotion of international communications.

4) To issue a new ORARI awards program to encourage all members to participate in award-hunting nationally and/or internationally.

"Without question, amateur radio has a bright future for development and growth in Indonesia. With a government sympathetic to it—and especially the provincial governments which are very enthusiastic [because of amateur radio's services in times when communications are otherwise lacking]—amateur radio in In-

donesia should be able to grow strong and heathy to become one of the giant radio societies in Asia and Oceania."

GENERAL INFORMATION

Amateur radio classes and privileges:

- YD—Novice—One-year license, local communications only, 10-Watt output, 80-meter band only.
- YC—General—Three-year license, national communications 75-Watt output, all bands except 20 meters.
- YB—Advance—Three-year license, international communications, 500-Watt output, all bands.

Obtaining a license: Foreigners should have a temporary residence or residence permit for Indonesia and be a national of a country having a reciprocal agreement. [As of a year ago: USA, UK, Canada, Australia, W. Germany, Netherlands, Sweden, Belgium, France, Argentina, and Finland.] Application may then be made with a "request to establish a station" using Form "D" and submitting it with copies of your residence permit, your valid amateur's license issued by your country, and your valid passport, and paying the annual fee of U.S. $7.50. Application should be made to the Directorate General of Post and Telecommunications through the *Daerah* (local, Provincial) level.

License class and privileges will be based on class of license possessed and will be issued for one year (renewable). A callsign prefix will be issued, in the range from AQA to AZZ. NOTE: Operation of an existing station by a transmitting guest *is strictly prohibited.*

New callsigns: When the YD to YB prefixes are fully allocated, a new combination as-yet not announced will be added. The following are in the conceptual stage: YE with one alphabet suffix will be issued for domestic special callsigns for field days, contests, experimental stations, national sports events, etc. A two-digit combination will be used for the two national events: ORARI anniversaries and the Republic of Indonesia Anniversary of the Independence. Secondary prefixes of 7A–7I and 8A–8I will be used only for international events such as World Communications Year, Amateur Radio Day (April 18), United Nations Day, etc.

General operation: Club stations on the *Lokal* (District) level are encouraged to promote activity for communications training—local nets, DXing, seminars, etc. Club callsigns are YB and YC prefixed, plus call area digit, with ZAA–ZZZ suffixes.

Repeater networks on experimental bases have been approved by the government and permits issued at the provincial or district level for supervision by the Province.

"By law, all members should participate in monitoring the amateur band and report any interference, discrepancies, or any activity not in accordance with the general rules of amateur radio." Implementation of this law produced good effects for a period of time, but a certain amount of "spectrum anarchy" resulted from the simultaneous (a) influx of VHF/UHF equipment, (b) governmental approval of Citizens Band use, and (c) the prevailing difficulties or nonexistence of public communications facilities. Involved were illegal importations of equipment, modifications of equipment for allband and wideband use which threatened creation of "a destructive situation for [amateurs] in a developing country since it will be utilized [legally] by commercial and public service parties which can occupy both parts of the amateurs' bands and [the other bands]." This presents "a great task for ORARI"—in education, supervision, and also "to implement strict disciplinary action for members" involved in illegal activities.

ORARI [it was reported at the IARU conference] has been making a special effort to "patrol" the bands, and apologizes for any disturbances which "were exported from Indonesia." IARU-member countries, Region III, were invited to file complaints of any such disturbances, "so that ORARI may forward [them] to the government for further investigations."

To be continued next month.



INDIA

Miss R. Subha
3 Thiru-Vi-Ka Road
P.B. No. 725
Madras 600 006
India

THE SEARCH FOR AN APEX BODY

Indian hams, despite attempts over a decade, have not succeeded in making their government accept any one body as representing their interests.

The Amateur Radio Society of India (ARSI) at New Delhi enjoyed a monopoly as the only country-wide organisation for over 20 years, but it specialised only in needling the WPC (Wireless Planning and Coordinating—a Wing of the Ministry of Communications), which is our licencing body, corresponding to the FCC in the U.S. It did not establish the type of healthy rapport that most IARU member societies enjoy with their governments. As the membership grew, this society became a hotbed of controversy, leading to a split and the establishment of the Radio and Electronics Society of India (RESI) at Bombay.

While refusing to recognise RESI as the sole representative of the amateurs (although it had on its rolls a majority of the licenced amateurs of the country), WPC suggested that it would recognize a federation of the various societies. However, when the Federation of Amateur Radio Societies of India (FARSI) was formed by all the societies except one (ARSI, naturally) and asked for recognition, WPC resiled and began to talk to *all* comers. This encouraged a number of aspiring leaders to claim to better represent the interests of amateurs than both FARSI and ARSI.

One of these was a small society based in Hyderabad, which, with some patronage from the ruling political party, sponsored a National Institute of Amateur Radio (NIAR). It was sanctioned by being awarded a grant of over ten million rupees [in 1984, slightly under a million U.S. dollars], a fourth of which was paid out, with the avowed purpose of promoting amateur radio in India. After two years, the government decided that it had waited long enough for results and began looking around for a new "apex" body upon which to bestow its financial favours.

The concerned government departments sponsored an unofficial seminar on April 12 to identify a new apex body. The outcome is reported to be a synthesised body called the Indian Council of Radio Amateurs, made up of representatives of the Department of Electronics, WPC, FARSI, NIAR, and five amateurs, VU2CPJ, VU2SDN, VU2KAJ, VU2KV, and VU2BSN. The objective of this apex body is stated to be limited to acting as a link between the amateurs and the government, and as a channel for disbursing the government's monetary benevolence.

To what extent this body will succeed in promoting amateur radio will be revealed by the efflux of time. Meanwhile, FARSI continues to represent over 60 societies, run a QSL Bureau, and publish its monthly journal, *Radio*. All this leads the ham-in-the-street to wonder whether an apex body can be imposed from above, by the government's fiat, or whether it should be built from grass roots by the support of its members.



REPUBLIC OF KOREA

Jongho, Yi HL1AFP
#1691–19 Bongcheon 6 Dong
Ga–Gu, Seoul 151
Korea

We welcome with pleasure Lee HL1AFP, our new correspondent for the Republic of Korea (South Korea). Now we will be able to catch up with developments since April of 1985, when we last heard from "the land of the morning calm." He writes us, "My English is very poor, I believe you will be re-editting very nice sentence, I really hope so." No way should that sentence be changed: It says exactly what it means with all the clarity one could desire and with more clarity than much that is written today in technically correct English. Lee's phone number is 884-9526 if you are in Seoul; dial 02 first if you are in Korea but not in Seoul; dial 82, then 02, then his number if you are direct dialing from abroad.

ASIAN GAMES CALL

My first news for you from the land of morning calm, Korea, is the special callsign, 6K86AG, for the 10th Asian Games to be in Seoul. We will use this call for 35 days, from 1st September to 5th October. We will be located at the KARL shack (Korean Amateur Radio League) from 1st to 19th September and at the main stadium for the games for the rest of the period.

We plan a Ham Press Center at the stadium and hope to be able to be helpful for foreign participants in the Asian Games at 6K86AG. I will be an operator there. Korean hams will be able to use 86 in their

AG PREFIX LIST

A4, A5, A6, A7, A9, AP, BY, DU, EP, HM, HS, HZ, JA, JT, JY, OD, S2, V8, VS6, VU, XV, XW, XZ, YA, YB, YI, YK, 4S, 4W, 70, 8Q, 9K, 9M, 9N, 9V, and HL.

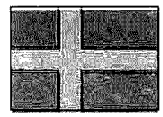
calls for the special callsign period—I can use HL86AFP, for example.

ASIAN GAMES AWARD

Available to all hams/SWLs worldwide, for the period of the Asian Games: HL-class award for those making contacts (heard) with (from) ten HL stations including at least one HL1 (Seoul) station; DX-class award for those who made contacts (heard) with (from) ten countries participating in the Asian Games, including HL, but contact with a station in one's own country will NOT count.

The commemorative station, 6K86AG, or any one HL86--- station and the Commemorative QSL cards will count as equivalent to five HL stations or five participating-country stations, whichever is applicable. (See box for prefixes of participating countries.)

Send Won 2,000, US $4, or 10 IRCs with GCR before December 31, 1986 (for HLs) or before September 20, 1987 for all others, to Korean Amateur Radio League, C.P.O. Box 162, Seoul 100, Korea.



SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S-155 00 Nykvarn
Sweden

RFI CAUSES POWER RESTRICTIONS

Interference problems caused by the lack of rf-immunity in home entertainment equipment is a major threat to ham radio. A recent RFI case here in Sweden indicates that the licensing authority is changing attitudes towards the radio amateur.

Up to the beginning of the 1970s, interference (TVI, BCI, RFI) was always blamed on the ham operator. During the 1970s, a slight change developed: If a device was not a radio or TV receiver but just an amplifier (tape recorder, stereo amplifier, telephone, and the like), the interference was not claimed to be the radio amateur's fault. He still had to cope with the neighborhood problems, though. In some cases the manufacturer of home entertainment equipment helped out, supplying and even installing filters for better rf rejection.

	1983	1984	1985
DL	136	177	137
LA	67	81	82
OZ	34	37	32
PA	32	20	26
W	24	21	21
G	17	22	21
Others	33	44	17

Table 1.

In fact, it is improper to talk about interference when the fault is in the unit itself, due to poor design. However, everybody talks about interference caused by the ham transmitter although the problem is produced within the interfered unit.

Early this year, a Swedish ham had heavy power restrictions imposed upon him because of interference in video recorders when he was transmitting. Video recorders are our new problem area, and you can never know when your neighbor is watching. On the 80-meter band, this ham is allowed a maximum output of 0.3 Watts (300 milliwatts)! Certainly there are QRPp fanatics who use such low power at times, but they do so on their own. To be forced to close down ham radio activity due to deficiently designed video recorders is outrageous and a threat against ham radio entirely.

This is a worldwide problem, and I would appreciate very much to receive any input on how this is handled in other countries. I am a member of the EMC working group in our league SSA.

THE FRO AWARD

The Swedish voluntary radio organization, FRO (Frivilliga Radio Organisationen), is celebrating its 40th anniversary in 1986. FRO is administered by the military service but most members are non-military. The Swedish military club stations are indicated by the prefix SL, and all FRO stations have in addition the letter Z as the first suffix letter, e.g., SLØZG, SL2ZYK; then there are the special stations: SL-FRO.

The FRO-40 Award may be won through contacts with FRO stations between May 24 and December 31, 1986, adding up to 40 points, as follows:

- Contacts with 7S1FRO, 7S2FRO, 7S3FRO (etc., one for each call area) are worth 5 points for Europeans, 10 points for DX; Contacts with SL-Z— or SL-FRO stations are worth 1 point each for Europeans, 3 for DX.
- All bands, including 10, 18, and 24 MHz are valid.
- Count each station once on each band, regardless of mode.

Mail your application with QSL cards, GCR list, and 30 Swedish kroner or U.S. $4 or 10 IRCs to FRO, Riddargatan 13, S-114 51 Stockholm, Sweden.

VISITOR STATISTICS

We hams always like to bring our radios with us wherever we travel. Thanks to reciprocal licensing agreements between various licensing authorities, we are able to obtain short-term visitor licenses in many countries. Sweden, however, does not require a mutual agreement for issuing a visitor license here. In European countries, these tickets usually are issued for three months and a fee is charged. In many cases, an application should be sent three months in advance. Hopefully, all this will soon be simplified by the so-called CEPT license that is supposed to be valid in most European countries without separate applications. Some countries, like Norway, Denmark, and West Germany, are in the process of accepting the CEPT concept.

During the last three years, Sweden has issued visitor licenses to hams from some 25 countries (see Table 1).

SM ON TOP BAND?

A handful of Swedish hams have been very successful on the 1.8-MHz band despite the restrictions we have, i.e., narrow band 1830–1845 kHz and only 10 Watts input. However, good antennas have helped. If you want to work Sweden on the Top Band, get in touch with Jan Skoldenberg SM5DGA, Backv. 13, S–752 52 Uppsala, Sweden. Jan is very active on that band and has current information on the others who also have good capabilities for 160 meters. Please be sure to enclose an SAE and IRCs if you wish him to send you any information.■

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46
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P.O. Box 4175, Vero Beach, FL 32964 (305) 476-8580

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards or odd-sized scraps of paper. Please type or print your request (neatly!, double-spaced, on an 8-1/2 x 11 sheet of paper and use upper- and lower-case letters where appropriate). Also, please make a 1 look like a 1 not an l—which could be an el or an eye, and so on. Hard as it may be to believe, we are not familiar with every piece of equipment ever manufactured on Earth! Thanks for your cooperation.

I would like to purchase a Fisher Model MPX-20 externally powered 4-tube multiplex adapter or a substitute for same. Will pay any reasonable price and expenses. Phone only if you have one: (216)-481-0274.

Herb Schieman KA8AZW
1910 Beverly Hills Drive
Euclid OH 44117

I need any information (schematics, manual, etc.) for the following frequency counter: BOHSEI Frequency Counter, M 7505, 10 KHz–30 MHz, Ebina Electronics Corp. Will pay any costs or copy and return.

Robert Carson Jr.
Box 364
Smithfield OH 43948

I would like to obtain the following Teletype bulletins: 120B, 252B, 254B, and 1044B.

C. T. Huth
229 Meimore St.
Tiffin OH 44883

Can anyone help me get a copy or photocopy of the owner's or service manual for my Hallicrafters S-120 shortwave receiver? Please write and let me know the cost before sending. Any help will be appreciated.

Steve Guelzo
318 Oak St.
Elgin IL 60120

I require service information for a pocket-sized VHF transceiver, model TR1007 by Rank Telecommunications, and also for a CHA Canadian Motorola VHF receiver base station. Any help is appreciated.

Errol May
R1 Lasalette
Ontario N0E 1H0 Canada

I need a schematic and/or owner's manual for a Dycomm 2-meter amplifier.

Karl Steinbach V.M.D.
PO Box 28
Harborton VA 23389

I need a manual and schematic for a Drake R-4, serial #1526. I will pay for shipping and/or reproduction. Let me know what you have.

Gary Mitchelson
295 I Snow Cap Court
Glen Burnie MD 21061

Please help me rehabilitate two CB amplifiers for use on 10 meters. I need schematics, manuals, or first-hand accounts on how to accomplish this. The two amps are:

The Squire 125, Electronics Unlimited, Lebanon, Tenn. (12 V dc) and

Marko XB-100, Cobra CB Radios (110 V ac).

I'm willing to pay reasonable costs for copying information on the above, or you can send material to me and I'll copy and return it.

Mel Riffe WD8NNL
4908 Western Rd.
Flint MI 48506

I need manuals, schematics, or information concerning a Hammarlund HQ-110 receiver, Hallicrafters S-40-B and S-38-A, Crown SX-711 tape recorder, and Crown International two-track tape recorder circa early '60s. In return, I have manuals for Hammarlund HQ-140-XA, Ampex 403 tape recorder (early '50s), and CQ "Command Sets" manual. Will copy sections you need.

Doug Walker
Route 2 Box 16
Tylertown MS 39667

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NEVER SAY DIE

from page 84

bring you $20 for a hundred readers.

As I mentioned a couple months ago, if I were a club looking for a newsletter editor, I'd start by finding out who has a Macintosh. The likelihood is that someone will have one. . . unless your club has been particularly nasty about getting youngsters to join. Old fogies are seldom Macintoshers. Even a C-64 can do the job, and I know you've got a few of those spread around the club.

You can get members with computers to zip in their copy via the club two-meter repeater. . . or by modem over the land line. You want to get reports into the newsletter on what DX your DX fanatics have worked recently. It's no good working it if you can't brag about it. You'll want a report on recent contests. Certificate hunters can brag on their latest wallpaper.

If anyone has sprung for the newest in ham gear, get 'em to write about it. You know they're busting to, if only you'll ask. And get 'em to bring it to the next club meeting so they can bask in the admiration of the less fortunate.

You'll want a report on slow-scan doings. . . what's new in RTTY countries. . . repeater news of new stations and channel changes. Has anyone made an interesting trip and brought back some slides or videos? I'm certainly not the only ham who gets off to interesting places.

Bermuda, For Instance. . .

In May I got over to Bermuda for a week for a President's Association conference. I had visions of basking on the beach. . . even took my suntan lotion, swim fins, mask, and Nikonos camera. The stinkers had sessions from 8 a.m. until around 7:30 p.m. almost every day! I came back as lilly white as I'd left. But I did get together with the VP9ers one night when they happened to have a club meeting. What a great bunch of hams! The .94 repeater covers the island so well I was even able to make contacts while riding in a taxi from the airport.

If you write ahead, it's easy to get a temporary operating permit, so W2NSD/VP9 hit the pavement running, HT in hand. You know, if you make a serious effort during the yearly Bermuda contest, you can win a trip to Bermuda to get your certificate! The club gets stations set up in every one of the nine Parishes and offers certificates if you contact all of 'em.

Bermuda is only an hour and a half flight from the East Coast, so you might start thinking in terms of giving it a try for your next vacation. The main (and almost only) industry is tourism, so you're going to have a good time. There are hotels and restaurants that cater to the rich, but there are plenty for the rest of us, too. I'm about as chintzy as they come, so I naturally seek out the better bargains. Sherry and I found a delightful restaurant on Front Street—it not only provided the best meal we had on the island, it was one of the most reasonable. . . the Longtail Restaurant. We were disappointed by the highly touted Green House at the Sonesta Hotel, Tio Pepe's, and Henry VIII.

You get around on Bermuda by moped or scooter. Since I've got a Yamaha scooter of my own, I went for the scooter. The speed limit is 20 mph for the island, but you have to go more like 30 to keep up with the taxis. The roads are all narrow, few with any shoulders. . . unless you call a ten-foot high sandstone wall a shoulder. Being a British island, the traffic is on the wrong side of the road, adding to the confusion. But the locals are used to thousands of mopeds and scooters in the hands of visitors, so they give the red license plates a wide berth and expect the worst at any intersection. There are surprisingly few accidents.

They don't have rental cars, so you either get around by taxi or by scooter. I preferred the freedom of the scooter, so Sherry and I covered the entire island with her clinging to my back. We did hit one short rainstorm. I just had on a shirt, so I got wet, but she didn't. I zipped under a big tree and waited a few minutes and the sun was out again and I quickly dried off.

here is the next generation Repeater

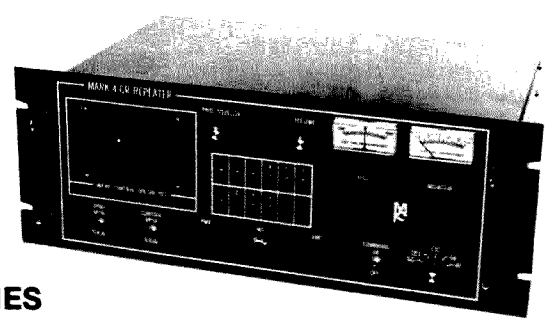
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The Program Chairman

Oh yes, I was writing about clubs, so let's get back to the program chairman's job again. You want action at the meetings. Whatever you do, don't let business meetings intrude on the fun. Business meetings are not fun. No, I don't care how involved the members seem to get, if you allow business to take much time, you're going to quickly thin out your club.

Part of the program is the show and tell of DXers with their silly DX QSL cards. Part is the contesters telling about an upcoming contest or how they did in a recent one. Get 'em to bring in their award certificates and show 'em. The certificate hunters will also oblige with this. How about a short slide show by your SSTV member, showing some recent DX he's worked? Find out what special interests your members have and keep after them to tell what they've done lately. This will spur them on to more and more activity. It'll also get other members interested in joining the fun.

Do you have a weekly club meeting over the repeater? This is where you can line up the talent for the next meeting. This is where you can find out who has been doing what and get them all set to show and tell at the next meeting.

This repeater meeting will help keep interest in the club high. It'll also make it possible for you to have special meetings on short notice. This also helps keep club interest high. In this case, I recommend you drop cards to every ham industry firm asking 'em to give you a call if a key person from the firm is going to be in your area in the future. Tell 'em you'd love to call a special meeting just to meet them and find out about their products.

I know I get around the country a good deal, but I don't usually think in terms of the local clubs arranging a special meeting for me. So I sit in a hotel room, wasting my time writing editorials or catching up on my reading. If I knew ahead of time the name of the club president or program chairman, I'd be able to give a call and see if a special club meeting could be arranged where I could meet everyone and give a talk. I'm ready, day or night, to talk... at length. I once managed six hours of talking in one day while visiting South Africa... giving talks for television, computer professionals, computer hobbyists, entrepreneurs, and hams. Whew!

So I'd suggest you plan to be able to gather ad hoc club meetings to fit the schedules of ham industry luminaries rather than trying to make do with just the few who are near enough to fit into your regular schedule. Between your club newsletter and your weekly repeater meeting, you should be able to get the word around and provide good turnouts.

Unless the ham industry people know you exist and are interested in them visiting your club, they'll get to your area on a business trip and you'll miss 'em. Tell you what, if you'll send me the name of whom to contact and the phone number, I'll run a quarterly list in *73* of clubs anxious to organize special ad hoc meetings for industry people. Let me know about how many reasonably live bodies you think you can muster on relatively short notice.

I happen to know the industry people do get around because every now and then they go as far afield as Peterborough. (You know, you could do worse yourself the next time you're vacationing in New Hampshire. Bring your QSL card and post it in the *73* offices. The offices are actually in Hancock, just north of Peterborough. When you call, we'll tell you how to find us.)

If you have someone who can act as a liason for visiting firemen... someone who doesn't get unelected after a few months... that's the best name to send me. Send it to Ad Hoc, *73* Magazine, WGE Center, Peterborough NH 03458. If you mark it to my attention, it could get lost for weeks while I'm off on a trip. So far this year I've visited Denver, Aspen, Miami, Orlando, Washington, Columbus, Dayton, Atlanta, Mobile, Tampa, Chicago, Dallas, New York, and Bermuda. Later this year I expect to be in Seattle, Vancouver, Vegas, San Diego, Quito, Lima, La Paz, Rio, Tokyo, Seoul, Taipei, Hong Kong, Kota Kinabalu, Bandar Seri Begawan, Kuching, Kuala Lumpur, Atlanta, San Francisco, Miami, and so on.

How about club mini-flea markets? Get that ham gear off the shelf... out of the drawer... out of the attic... out of the cellar. Get it to someone who can have fun with it. Have you tried a flea-market table as part of your club meet-

ings? It's a way to get some cash for almost anything. You might want the club to get a 10% commission on sales to build up the club treasury.

A *73* Table

Another way to scrounge some cash is to convince club members they'll enjoy reading *73*. We have a special club deal, if you're interested. Hey, none of this making up an instant club to get a discount, okay? I want to see a membership list, a club newsletter, or something. Write to Club Deal, *73* Magazine for the gory details. If you're going to have a hamfest, big flea market, auction, picnic, or something, you could do worse than run a *73* table.

I have a lot more ideas for you on getting your club into gear. But don't make me do all the work... if you try something and it's successful, drop *73* a line so we can pass your idea along to help other clubs grow.

ADS IN PERSPECTIVE

For some reason many hams have the feeling that selling things to hams is kind of tainted. Part of this probably stems from the ham urge to build our own equipment, which results in a subconscious annoyance when commercial ham gear is far better and cheaper than we can build. It perhaps generates an inferiority feeling which expresses itself subtly as envy and jealousy.

Then, too, there is the teacher's syndrome—we're nonprofit, so anyone selling things to us for a profit is taking advantage of poor, downtrodden us. This is the justification used by teachers for mimeographing and photocopying copyrighted books and making illegal copies of copyrighted software. It's okay for me to steal because I'm giving it to the poor—I'm Robin Hood. There's always been this feeling that it's okay to steal from the rich—they're different. After all, they've got plenty, so what's it hurt?

In the ham industry we don't have very many rich people. We have a hobby that has been running down for 23 years—where the average age of the ham is now 56—where newcomers dropped 8.5% last year and 7.9% the year before—a smaller and smaller market as more hams go into retirement and have to find a way to live on Social Security... which often means no more ham gear.

What on earth gets into someone to get into such a dying market? Of course the big firms today are Japanese. In Japan amateur radio is a huge hobby. They've licensed about five times as many hams as we have and there are ham clubs in every school in Japan turning out tens of thousands of young, eager hams. Their ham magazines are four times the size of ours. It's only logical for this to be the amateur radio capital of the world now.

Though the big firms are all Japanese, we still see hundreds of small firms—American firms—what about these? Most of 'em got started when a ham built something different. Ham friends then say why don't you make that and sell it? Often the ham will get together with a friend and decide to give it a try. They are amazed at how cheap parts are when you buy them in bulk—nothing at all like the prices for parts on a card in a Radio Shack—about the only parts source left these days for most of us, now that all the parts stores are out of business.

So two (sometimes three) hams start a company making something for packet radio, for repeaters, for slow scan, maybe an antenna. They run ads in *QST* because that's the biggest magazine. They get a few orders and requests for literature. They don't know a blessed thing about advertising, so their ads are lousy and their literature worse. They limp along, getting enough orders to keep in business. They try ads in the other ham magazines and find that some do better than *QST* and some do worse—a whole lot worse.

I've been studying advertising ever since I took a course in it at the Advertising Club of New York over 20 years ago. That was one of the most valuable courses I've ever taken, yet I know of no college with anything remotely like it—one of the reasons I'd like to get into the college business.

It turns out the basic rules of advertising are fairly simple. You also discover that surprisingly few people working in advertising know what the hell they are doing. Unfortunately, like learning almost any other skill, you find the normal human reflexes are almost invariably wrong. If you try to learn to ski by doing what comes naturally, you'll never make it. Ditto horseback riding, and so on.

Dan's Got It All

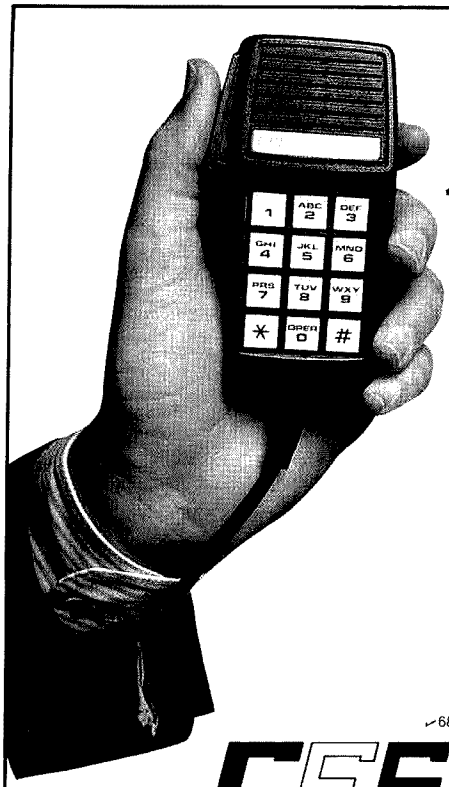


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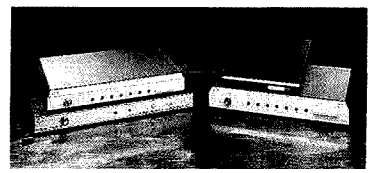
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So, since virtually no one in the ham business has ever learned the fundamentals of advertising, and since most ads in ham magazines are written by these folk, guess what? I'm not picking on ham manufacturers and dealers; we have the same situation in the computer industry.

The obvious move is to turn to a professional, right? Har de har. Yes, there are a few ad agencies that know what they are doing. Some are doing a beautiful job of advertising for their clients. But sadly, there are more agencies that are turning out ads that aren't selling the product. These often are highly paid agencies, too.

A chap I know hired a manager to run his new company. The manager hired on a very expensive ad agency. The ads were simply awful and, surprise, the product didn't sell worth beans. So the chap fired the manager, did the ads himself, got the product moving, and sold the firm for several million dollars. The new owner, despite warnings, went right back to the expensive agency and quickly brought sales to a halt. I tried to talk with the pompous blatherskite from the agency, but found no one really at home.

I'd like to give an advertising seminar for the ham industry, but I don't know of any place to get 'em together. I dropped a note to every firm in the industry suggesting meeting a day early at Dayton and got just one response. When you consider that the difference between an effective ad and a poor one can be well over a ten times difference in sales, I wonder.

One of the services I'm planning for *73* will be a reader vote on the ads. As soon as I can set up a computerized system for tallying the results, I'll have a way for you to tell the *73* advertisers which ads you find most interesting—and which are turkeys.

I don't have to explain the function of advertising in a ham magazine do I? The ham magazines are about the only way the ham industry can let you know what they're selling. Most of us are interested in buying new ham gear now and then. It's fun to get something new and put it on the air.

Half the income for ham magazines comes from ads, so they're critically important to a magazine's health. Very few hams are interested in paying double the current subscription prices for their magazines. In *73* my rule of thumb is that every two ad pages allows me to print another three pages of text—so the more ads, the fatter the magazine. We make our profits with our other magazines, so we can afford to run *73* at no profit. Remember, the main reason I took back *73* was to use it to get amateur radio growing again. I already have more than enough to do in what little is left of my life without *73*.

When we get amateur radio into a strong growth mode, there will be many opportunities for hams to start new enterpreneurial firms and do very well. During the computer growth years, we saw hundreds upon hundreds of new millionaires. Some kept it, some blew it. Some did incredibly well.

For those few of you who don't think making a lot of money is a terrible thing to do, there have never been so many opportunities to get rich as we have today—and hams have an edge. I'll be writing more about this if I get any encouragement. My past experience has been that most hams don't want to be bothered. Many feel so defeated that they can't even imagine gambling on something new, even in their spare time.

Of course I understand that many hams have no spare time. When they're not sitting there with an 807 in hand, maintaining their expertise with baseball, football, or basketball statistics, they are rag-chewing on 75m, grumbling about the QRM. If the shoe fits... remember that I started out with nothing but the guts to put everything I owned into printing the first issue of *73*. I worked very hard for years and went through several major traumas, seeing little success for the first 15 years. No complaints, I published *73* because I enjoyed it and the hundreds of hundred-hour weeks were both fun and agony.

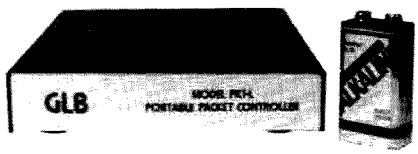
Older hams may be starting to think in terms of some sort of business to run in their retirement. It's better than trying to live on Social Security and eating cat food. Some like the idea of a shop—some prefer a mail-order business since it offers much more freedom. There is no end to the potential small mail-order businesses, so if you're interested in that I'll try to write about it occasionally. It's up to you. If you prefer me to write about the awful band conditions all the time, okay.

If you do decide to go into business, for heaven's sake learn all you can about advertising—you're going to need the best ads you can get no matter your business.■

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PROPAGATION

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

September should bring some very disturbed conditions blended with excellent fall propagation on the HF bands. Expect an unsettled geomagnetic field on the 1st and 2nd, and an active field from the 5th or 6th through the 10th. We may see the return of significant sunspot activity—and possibly a flare! Earthquakes and volcanic eruptions possible around the 2nd and 11th.

G=Good, F=Fair, P=Poor, *=Disturbed magnetic field coupled with some unusual geophysical conditions (50–75% probability).

SEPTEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F	2 P	3 F	4 G	5 *	6 *
7 *	8 *	9 F	10 F-G	11 P	12 F	13 G
14 F-P	15 P-F	16 F-G	17 G	18 G	19 G	20 G
21 G	22 G	23 G	24 F	25 F-P	26 P	27 P-F
28 G	29 G	30 G				

IN
Yaesu
-767GX! (see p. 81)

Issue # 313
Oct. 1986

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0 10
74820 08723

NEVER SAY DIE

Number 20 on your Feedback card



THE EARTHQUAKE

We're assured that one hell of an earthquake is coming to California—and fairly soon. The quake is inevitable, only the date is in question.

Further, we're told by experts who have put the data into computers that we can expect tens of thousands killed and at least a hundred thousand or so injured. Golly, it's almost enough to make a person think—so, making an unusually mighty effort, I thought. You don't want to know what I thought, it would only depress you. Why not skip on to the next break in my stuff—to something which is even more frightening to think about. Oh, I'm going to get your well-deserved guilt stirred up to a fever pitch.

Now, when the Big One hits, you know as well as I that two main things are going to happen. First, buildings will be crashing all over the place, killing and injuring an incredible number of people. Second, power, water, and telephones will be completely wiped out. And you know what that means—the *only* practical communications will be by amateur radio.

Repeaters, unless they have emergency power, will be out. It won't be possible to fix 'em because most roads and highways will be damaged beyond immediate repair. What roads there are left will be jammed with cars trying desperately to escape the area.

Ham communications will be the backbone of the disaster relief—making it possible for the authorities to contact each other—to send out rescue teams via motorcycles or helicopters—to get medicines delivered.

Hams will have to cope with hysteria, questions of who really is in charge, food, water, and medicine distribution, fire storms, gas leaks, floods from broken dams, bodies to be buried, injured needing medical attention, gasoline distribution, rioting, gangs of thieves, etc. Then, once the more serious emergencies are taken care of, comes the welfare message blitz—millions of people unable to use the telephones or get out of the area wanting to locate loved ones, family, and friends. Messages within the devastated area—messages coming into and out of the area. We're talking millions upon millions of messages.

We're not talking a handful of hams on 80m with hand keys tapping out messages at 10 wpm all night for a few days—we're talking tens of millions of messages over a period of weeks to months. We're not talking about anything we even remotely have in prospect right now in a message-handling system.

We're also not talking about what few hams we apparently are going to have left—probably with an average age of 60 or so. What few of you old buzzards who haven't ruined your lungs and body beyond repair with 50 years of smoking or carrying around 50 pounds of fat hanging over your belt may have the stamina to last for a few days, but that isn't going to cut it.

What you're going to give any-

Continued on page 10

Caption This Cartoon—And Win!



Write the funniest caption for this K4PP classic and win a one-year subscription (or extension) to 73. Limit your caption to 73 characters, including spaces and punctuation. Entries must be postmarked by November 1, 1986. We'll run the winner in a couple months. Mail your knee-slapper to: 73 Magazine, Editorial Department, WGE Center, Peterborough NH 03458, Attn: Knee-Slapper.

QRM

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Sweet Sweeps

THE BIG WINNER in *73*'s Powerhouse Sweepstakes is **Judi Booker N4NMH**. Judi has received her complete TM-2570A station and says she loves it! (See "Letters" in this issue for more from Judi.) Kenwood's Wayne Yoshida KH6WZ flew in from the West Coast to draw the lucky entry and visit with the *73* staff. If you didn't win this time, there's another opportunity for you this month: The brand new *73* **Megaband Sweepstakes** featuring Yaesu's FT-767GX is officially under way! (The entry blank is on page 81, but we encourage you to first read pages 1–80. We'd hate for you to miss anything important.)

Ten Returns

AMSAT-OSCAR 10 is feeling much better now thanks to the tireless efforts of AMSAT engineers. After two months of cautious diagnostics, the spacecraft's computer operating system was rewritten to avoid the areas of memory that were damaged by radiation. (High-energy particles traveling through the satellite can damage cells of memory; the number of damaged cells had grown too large for the computer's error-correcting system to handle.) **Karl Meiner DJ4ZC** produced the crucial memory map that showed which areas were faulty. The satellite is now in stable condition and running on a reduced operating schedule, with the hope that more user time will be available in the very near future.

Packet Lunacy

TOM CLARK W3IWI has had success in bouncing packets off the moon using an 85-foot dish located at Gilmore Creek near Fairbanks, Alaska. 140 Watts into the 38-dBi-gain antenna yielded about 700 kW of rf at 432 MHz. While no connections were established, Tom monitored several time-stamped packets which displayed the 2-second round-trip delay. During the outing, 19 stations were worked on CW/SSB. Activities were cut short a few days due to the intense boredom produced by the lack of active stations.

Racy Award

THE REDCLIFFE RADIO CLUB of Queensland, Australia, has come up with one of the most complicated awards I've ever seen. It appears to be some sort of road rally done by radio . . . what you do is work cities in order along a circuit that travels all around Australia. There's some sort of bonus allowed when you do this in a certain amount of time, and time penalties just to make things interesting. Here's an example of how the rules read: "To encourage inland contacts, should the return to the coast be at the location where the coast was left and the second contact is not with the same station or if the same coastal station is worked after 48 hours have elapsed, the inland contact is worth an extra 50 points." I should point out that the award sounds really sharp; if you'd like to take a shot at figuring it all out, send an SASE to *73* Magazine, WGE Center, Peterborough NH 03458, Attn: Rally. I'll send you your very own copy of the rules.

ACC Expands

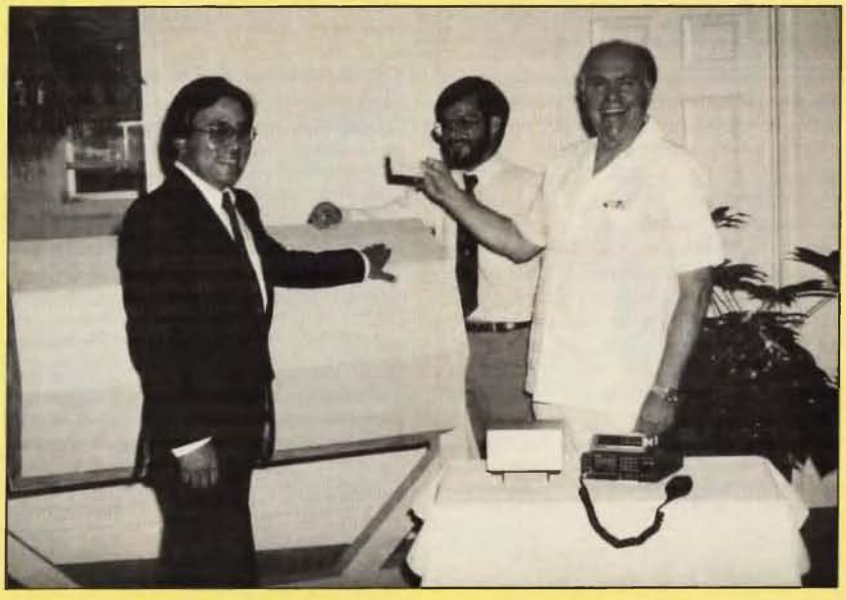
ADVANCED COMPUTER CONTROLS has moved to a new facility in Santa Clara, California. Their new address is ACC, Inc., 2356 Walsh Avenue, Santa Clara CA 95051; (408)-727-3330. A dedicated technical support line is also up at (408)-727-3414.

Go FAR

THE WINNERS of the 1986 Foundation for Amateur Radio scholarships have been announced. They are: James Baker KI4YN (John Gore Memorial, $900); Richard Westenberger N9DKR (Richard G. Chichester Memorial, $900); David Tancrell KB4GIA (Edwin S. Van Deusen Memorial, $350); Michael Kazigian KA2MRK, Leslie Ann Redman KA9PCV, Michael Silverglate KR9Q, David Swiatlowski KA2KLM, Diane Willemin KE8DJ, and Tony C. Wood KB4DNE (QCWA Memorial, $600 each); Douglas Swiatlowski KA2KMT (QCWA Robert Cresap Memorial, $500); Francis Horan KA3CJR (Radio Club of America, $500); Joy M. Davis KE8EG (Edmund B. Redington Memorial, $500); Carol Dunlap KA1NCX (Young Ladies' Radio League, $500); Michael Krensavage KA3CUP (Amateur Radio News Service, $750); Bernard Collins KA3FGV (Columbia Amateur Radio Association, $750); Christine Gray KA3NAR and Eric Smith KA3KJO (Baltimore Amateur Radio Association, $500 each); and David German N4FAD and Todd Wiggins KB4BDK (Dade Tropical Hamboree, $500 each).

Pool Rule

VOLUNTEER EXAMINER COORDINATORS have now been given the responsibility for maintaining the question pool used for ham license examinations. This latest action deregulating the volunteer-exam system was announced at a meeting between VECs and the FCC in mid-August. The Report and Order also specifies that volunteer examiners are the final judges to determine whether or not a question has been answered correctly. The volunteer examiner will also design each exam along guidelines set up by the VEC. The new rules are flexible enough to allow less traditional methods of giving a test, such as an interactive computer program which asks questions and immediately grades responses.



At the 73 Powerhouse Sweepstakes drawing (l to r): Wayne Yoshida KH6WZ, Perry Donham KW1O, and Wayne W2NSD/1.

Instant License

WE'RE A FEW STEPS CLOSER to an international amateur radio license, at least on this side of the world. The Inter-American Telecommunications Conference, a function of the Organization of American States, now has a draft of the **Inter-American Amateur Radio Convention**, a document that would set up a formal structure of reciprocal licensing between member nations of the OAS. The agreement will be presented to the Conference in November of 1987; meanwhile, OAS nations are being given the chance to make comments on the draft version. If the Conference gives the stamp of approval, it would be up to each individual government to ratify the treaty. A similar "universal license" is being worked on in Europe... will we someday see a single worldwide ham radio license?

Welcome!

THIS ISSUE of *73* sees the addition of three new columns and a new columnist. **Mike Bryce WB8VGE** is the new columnist; he takes on "ORP." **Ralph Taggart WB8DQT** of *The New Weather Satellite Handbook* fame will be keeping you up to date on... you guessed it, weather satellites in "WEATHERSAT." **Mike Stone WB8QCD**, Editor of *SpecCom Journal*, will be writing about amateur television in "ATV." And "DX" returns to the pages of *73* with an author every DXer knows but who has asked not to be named until next month. Hmm... I wonder if that means he doesn't want to be paid until next month? Don't forget to rate these new kids on the block by filling out the Feedback card and mailing it in—along with your subscription order, of course!



Here's Russ Rennaker W9CRC at his 80th birthday party... are you 80 feet up, Russ?

Captain Caught

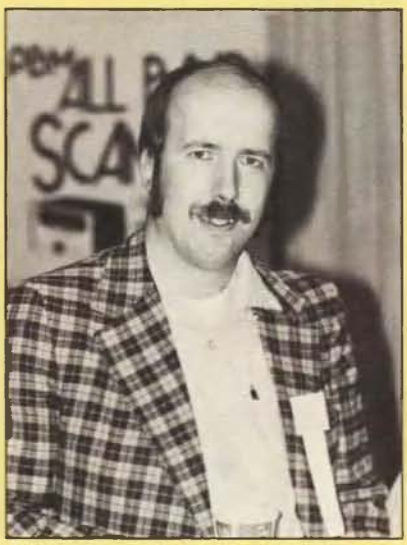
CAPTAIN MIDNIGHT, the enterprising fellow who took HBO off the air for 4-1/2 minutes last April, turned out to be **John MacDougall KA4WJA**. John protested HBO's decision to scramble their satellite signals by overriding the HBO signal and displaying his own message across the country. The Justice Department and the FCC tracked MacDougall down by the process of elimination: Only two of the few earth stations powerful enough to do the deed use character generators that match the one used in the protest. The maximum penalty for transmission of a false satellite signal is a $10,000 fine and one year in prison; after plea bargaining it appears that the sentence may be reduced to a $5,000 fine, one year on probation, and the surrender of John's ham license for one year.

18 Or Bust!

THE AMERICAN RADIO RELAY LEAGUE has filed a petition with the FCC seeking early access to the 18-MHz amateur band defined in the last World Administrative Radio Council. The ARRL feels that there is plenty of room for U.S. hams on the band, and pointed out that the government has shifted its stations off of 18 MHz, and that the few nongovernmental users have long since vacated. Fifty-seven countries currently permit amateur activity on the band.

Hambassador

THE WINNER of the first **Ham Ambassador Award** sponsored by Advanced Electronic Applications is **Mary Duffield WA6KFA**. The award, presented at the 1986 ARRL National Convention in San Diego, is based on dedication to amateur radio, influence on non-hams, and the initiation of special projects and programs to promote our hobby. Mary is a 70-year-old retired schoolteacher who keeps herself busy by taking ham radio to the masses, including designing and running a for-credit class in ham radio at the Del Mar Middle School—a program chosen by the California School Administration as one that should be copied throughout the state. Mary was presented with $1,000 as a way of saying, "thanks."



Ralph Taggart WB8DQT, our new WEATHERSAT columnist. Welcome aboard!

SCRAN Plan

MEMBERS of the **South Coast Radio Amateur Network** (Torrance, Calif.) recently pulled out all the stops to provide communications for the California Special Olympics. Over the three-day event, 37 hams handled several thousand messages ranging from a request for paper cups to medical emergencies. A portable repeater was installed to provide reliable coverage over the UCLA campus. The Special Olympics are designed to give mentally handicapped folks "the opportunity to develop physical fitness, gain new friendships, express courage, and improve their self-image." SCRAN member Henry Schmidling WA6RJA reports that the amateur volunteers "received much more than they gave."

Section Election

THE ARRL EXECUTIVE COMMITTEE has decided to create a new ARRL section: West Texas. The effective date is January 1, 1987.

Finis

OK, enough of this stuff. Thanks this month for help from *Westlink Report*, *Gateway*, *The ARRL Letter*, *Amateur Satellite Report*, and *The W5YI Report*. Send your news items and photos to *73* Magazine, WGE Center, Peterborough **NH** 03458, **Attn**: QRX. See you next month!



Wayne W2NSD/1 took some time off to head north and operate VE7EXPQ.

NEVER SAY DIE

from page 4

thing for will be high-speed automatic communications systems using emergency-powered repeaters which will take typed messages and relay them where directed with no human help. We have the technology to set up such a system right now. What we don't have is the manpower to put it together and make it work. We don't have half the hams we need to set up the system we need.

According to the best count we have a bit over 400,000 licensed amateurs in the U.S. Of those it's estimated that 50% at most could even remotely be called active. It's more realistic to think in terms of maybe 100,000 fairly active hams. About 15% are in California—15,000 hams. At least two-thirds won't be near enough the disaster to help directly—leaving us with maybe 5,000 hams to handle several million messages. Sure.

Perhaps our best bet is to just give up—admit it's beyond us and wait for El Biggo to hit—then sigh and do the best we can with what little we've set up and accept a few thousand more dead as a result—hoping it won't be our family paying the price of our unpreparedness.

Now, The Nukes

A few months ago I mentioned the FCC's Long Range Planning Committee and its hope of setting up an emergency communications system which would be able to cope with the communications needs of a nuclear attack.

When the FCC found the ARRL directors adamant about stopping their move toward a no-code license, the FCC Commissioners could see no way for amateur radio to develop the million or so young hams it would need before it could organize the needed automatic high-speed communications system. They recognized that the few hams we have left—with an average age of 56, and aging fast—were hopeless.

I'm sure the ARRL directors never gave any consideration to the urgency of the emergency our country faces. Instead, they emotionally reacted, reflecting their own personal feelings rather than intelligence. The Commissioners were absolutely disgusted at this shortsightedness. They disbanded the LRPC.

Since the thought of a nuclear war is so terrible that we generally just dismiss the possibility, there doesn't seem to be any real emergency involved. A nuclear attack is impossible—right? Heck, with a growing number of scientists predicting a nuclear winter which could devastate most of the world, we're sure that even Russia would never start nuking us.

Alas, there's one aspect of this which far too few people have considered. Frankly, I've given it a good deal of thought and I agree with a growing number of scientists that a nuclear attack isn't just possible, it's almost inevitable. No, make that inevitable. I don't see any way it can be avoided.

The nuclear attack I'm talking about will probably hit either New York or Washington—more probably New York City. And when is this expected? The probability is high it'll be within the next ten years—could be five. It's highly unlikely to be more than ten.

If you've been reading your scientific and news magazines, you know that they've got nuclear bombs down to where they can be backpacked into a country now. If smugglers can bring in hundreds of tons of drugs a year, I don't think they'll have a lot of trouble with a few pounds of nuke.

Where can they get a nuclear bomb? You've read about several students who have, just by researching declassified material, designed atom bombs which our nuclear scientists say would be quite effective. Anyone can make one if they have the materials.

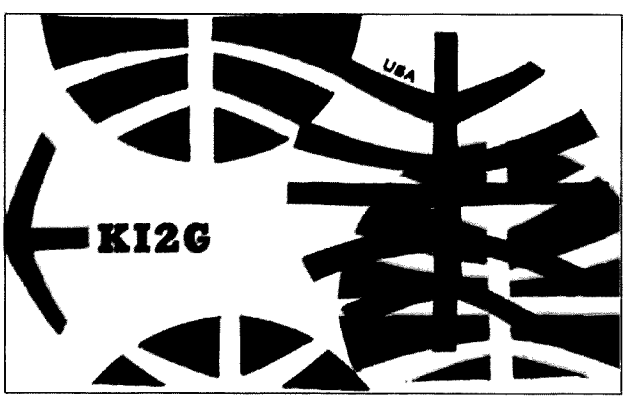
We know Kaddafi was trying to build a reactor so he could produce weapons-grade materials. We also know he's a bit miffed with us right now. Then there's the reactor they're building in Iraq—not one of our best friends in the world. And another in Pakistan—one in India—China—Israel—France and so on. A dedicated group could seek out a weaker defended source and load up. Making the bomb and getting it into downtown Manhattan would be relatively simple.

In case it's skipped your attention, Israel's West Bank problem has spawned a growing number of fanatics—people who are dedicated to killing themselves and as many as they can take with them. There is no bargaining with these people. They're mad and they're not going to take it any more.

And if you figure that giving the West Bank back to the Arabs will help, please don't forget that there are a bunch more fanatic groups—many angry with America. New York City, where a nuke could wipe out two or three million people and injure 13 million more, is a very attractive target.

A few years ago I had a visit from a chap who had worked for me back in 1962. Nice chap. He'd gone into social work in Brooklyn. Well, he had a strange story to tell when he visited about 15 years

Continued on page 78



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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LETTERS

Number 18 on your Feedback card

THUMBS UP

I wanted you to know how much I enjoyed the July 86 [Clubs] issue of *73*—so much that I've taken a two-year subscription. There was so much of interest in there that I couldn't put it down all week while on vacation. Please keep up the good work.

Bud Gray W1HMT
Windham NH

THUMBS DOWN

Whoever decided to make August 86 [Packet] a one-issue magazine should be fired as a liability to Wayne Green Enterprises. I am paying for a *ham radio* magazine, NOT a computer magazine.

Dennis Bernier WA1WIA
Pawtucket RI

THUMBS UP

I am proud again to be a subscriber to a fine magazine such as your August 86 issue. Here in east Tennessee, packet radio has just begun to gain momentum. I have very little time to acquaint myself with the new and varied interests of ham radio. It is nice to pick up a copy of *73* and learn, first-hand, about these interests. It took a lot of courage to fill an issue of *73* with "pure packet," but I am glad that you folks were courageous. Your courage and your sense of adventure brought me back to *73* after a much too long hiatus.

John Dolan WC4M
Greeneville TN

THUMBS DOWN

You talk about getting new and young blood into ham radio—take a real close look at your August 86 issue. Do you really think a Novice or pre-Novice could understand one single word? Granted, packet radio is hot, but with whom? Amateur radio is a hobby . . . not a religion to be followed as the high priests (read old farts) dictate as the only road to salvation. What happened to the articles that could be read and understood by those who are new hams and those who wish to be new hams? What about easy, useful construction projects that some of us dumb bastards can understand? Let's have some of the old *73* and let's try to remember that we're all not electrical engineers.

Name withheld

"Pre-Novice" sounds like Cro-Magnon! Just because you couldn't figure it out doesn't mean that the rest of the world can't (excluding a few of the folks I hear on 75m). Packet is what a million young hackers are looking for . . . a new way to use their beloved computer. Trust me, they understand every word.—KW1O.

SWEPT AWAY

It was indeed a surprise when I received Stu Norwood's phone call informing me that I had won a Kenwood TM-2570A in *73*'s Powerhouse Sweepstakes. It was a surprise because I had not entered: My OM, Jim Wilcox K4JAP, had entered my name as well as his brother's. Needless to say, it was a great thrill to win such a great piece of Kenwood equipment.

I already have a Kenwood TH-21AT. It's been a very useful HT for me because it fits in my pocketbook and I can take it anywhere. Jim has a TS-930S. So you can see we're pleased with Kenwood.

We enjoy *73*, and I especially enjoyed the August 86 issue on packet, since this is an area I've become interested in lately. I haven't purchased any equipment yet, but the information in that issue will be helpful in making decisions. Keep up the good work.

Thanks for declaring me a winner. The TM-2570A is already up and running as a base station. Oh, and one last note: Jim asked me to say, "Welcome back, Wayne."

Judi Booker N4NMH
Falls Church VA

YOUNGEST YL

With regard to your QRX column in August, Her Royal Majesty Princess Raya of Jordan JY2RBH [born this year] has to be the youngest YL ham and perhaps the youngest licensed ham.

However, I congratulate Jill KA9VGW and wish her many years of happiness in ham radio.

John Manna WA2MTR
Bridgewater NJ

OK, how about "Youngest Active Non-Princess YL"?—KW1O.

THANKS, DI

Your artist, who signs himself DKR, has displayed a keen talent for showing us as we are. I'm talking about that picture on pages 36 and 37 of the July 86 issue. I hope we see more of his work.

Paul Schmidt W9HD
Bloomfield IN

DKR is Dianne Ritson, our multi-talented art director who designs our covers and does a hundred other tasks, too. Here's a look at Di.—KA1MPL.



W2NSD/Rx

Congratulations on your editorial regarding gutter language on the ham bands (June 1986). The treatment you prescribed is excellent, and I hope it is applied as often as needed. Keep up the good work.

Ivan T. Schultz K0GP
Humboldt IA

DEAR ARRL,

What a sad day it was when I opened my June, 1986, *QST* and found that the League has endorsed the proposal for enhancing the privileges of the Novice license! I don't really mind the 220-MHz and the 23-cm additions, but to give Novices 10-meter phone is preposterous! With the number of headaches and lack of control the FCC has faced from amateur radio as of late, not to forget the problems that the Citizen's Radio Service created, why can't Uncle Sam and the ARRL learn from past mistakes?

I certainly want more youngsters to enter amateur radio, and I speak first-hand since I entered as a Novice at the age of ten (I'm twenty-nine now). But the League certainly seems to be placing more concern on the quantity, rather than the quality, of new amateurs. With the declining number of Novices and declining ARRL membership, is the League taking the position that it is more important to stay financially secure and impress the government with the sheer number of licensed amateurs? I think the answer is yes.

A few phone privileges are fine; I can even remember using AM on 2 meters when I was a Novice. Use of CW and digital modes is great, too. But giving the Novices SSB in the 28.3–28.5-MHz segment is asking for trouble from the CB lids who will slide their 110% modulators up to the 10-meter amateur band and create chaos and frustration for *all* amateurs, both in the U.S. and abroad. The League has been so forward in preserving our precious band space, so why not support the use of the 50–54-MHz band for Novices, and increase the 6-meter population and justify our continued allocation that is threatened at this very moment?

Please, please reconsider the granting of 10-meter phone privileges to Novices, and put the emphasis on the *quality* of amateur radio operators, not simply the *quantity*.

Paul Passman WB0BBC
Lenexa KS

Of course the ARRL endorsed Novice enhancement—the ARRL proposed it! (Actually, there were a number of petitions before the commission regarding expanded Novice privileges, but the text of PR Docket 86-161 is essentially the League's.) And it must have been an exceptionally sad day when you opened up the June, 1986, issue of 73 and discovered that we endorse it, too.

We need Novice voice on ten meters so that they can get a taste of what it's like to operate SSB on HF. There's already a "Novice" license for six meters—our current Technician class. The Techs aren't exactly shoulder-to-shoulder on six; there's no reason to believe the Novices would populate it either.

Finally, you'd better believe

we're worried about sheer numbers. Maybe you haven't noticed, but amateur radio has experienced "negative growth" for the past several years. If something isn't done very quickly to reverse this trend, there soon will be nothing to stop the commercial radio concerns from taking the spectrum from us that they want so badly. In Washington, it's sheer numbers that count. —KW1O.

A/S OK

I would like to bring to the attention of your readers an exceptional amateur radio company, The Antenna Specialists Company of Cleveland, Ohio. After contacting A/S regarding a replacement part for my 10-year-old 5/8-wave, 2-meter trunk-mount antenna which had developed an internal short, I received the required parts free of charge in less than nine days. I am very impressed with this type of service and highly recommend A/S products to all.

Michael Weber WB8RDN
Sterling VA

GLASS HOUSES

Though once considered a man's hobby, amateur radio is now seeing a growing influx of YLs. Some narrow-minded OMs are voicing their concerns about the growing number of licensed YLs and the long-term effect on "their" repeaters. Many have expressed fears that the bands will soon be overrun by inexperienced YLs who will turn two meters into a glorified CB band filled with meaningless gossip.

To be adequately prepared for entering the world of repeater operations, I, a newly licensed Technician, turned to the FCC manual on Rules and Regulations. A basic description of repeater operation was given, and it also suggested that I monitor the local repeater to observe accepted operating procedures. The following is a list of accepted topics compiled from my monitoring. You may talk about:

- Baseball, football, cheerleaders, and the girls in the stadium
- Your favorite restaurant, the foods you are most hungry for, how long it has been since your last meal, and even recipes
- The weather conditions, amount of rainfall, and cloud formations
- The stars and the moon
- Car repairs, home repairs, or even vacations—but if you're a YL don't mention household chores or you'll be accused of trashing the airwaves
- Your wife's moods, dermatology problems, and dental problems
- Gardens, grandchildren, pets, or the old lady back at the QTH (I thought Q signals were for nonverbal communications)
- Golf, cycles, fishing, guns, or photography
- (On Sunday) church, choirs, attendance, ministers
- Road construction, the car in front of you, and the car behind you—but if you're a YL, don't mention that you're mobile chauffeuring children or you'll be accused of misusing the repeater

OMs are allowed to ask: What's up? What's happening? How are things with you? If you're a YL, you'll be accused of gossiping and it will be implied that you should stick to the telephone.

If something is funny, don't laugh or you'll be accused of being tacky. HI, HI is acceptable. Don't giggle or you'll be accused of flirting.

It is acceptable etiquette for an OM to sneeze, cough, clear his throat, or burp into a keyed mike.

We YLs worked just as hard as you did to get our licenses and we hold the same pride in our accomplishments that you do. We also are unimpressed with the CB mentality and want the ham bands to maintain the high standard of operation that first attracted us to this hobby.

So, OMs, please listen first before you cast stones.

Name withheld
due to lack of guts
(I'm no fool—I'm married to an Extra-class OM who subscribes to this magazine.)

QSL ESL

I teach seventh grade world history and English as a second language (ESL) at Horace Mann School in Beverly Hills. Last year I applied for a grant, and the State of California came through with some bucks for shortwave equipment for my classroom. Your tax dollars at work.

I bought an ICOM IC-R71A, an IC-R7000, and all the accessories. I put up a 42-foot trapped dipole for HF and a super-wideband discone for VHF/UHF. I have a lot of kids just listening right now, but this fall I hope to get a licensing class going.

Your efforts and ideas on attracting new blood into the amateur ranks are right on target. Get them at this age level. Increase Novice privileges. Develop and distribute a comic book. All good concepts.

A lot of hams simply take themselves too seriously. They detail their trivial daily activities. They're snobbish to the newcomer. They endlessly explain personal problems which are of very limited interest to anyone else.

After years of listening, I didn't finally get off my duff and earn a ticket just to join a dying hobby. I think things *can* be turned around.

Craig Dible KB6LAK
Marina Del Ray CA

Sure, there are a lot of dimwit ops—and it soon becomes obvious there's no sanity section in the ham exam—but with the right bait you'll find some charming chaps and have plenty of great contacts. Someday someone will write an article on how to sort out the wheat from the chaff. I hope.

The merciful thing is that a high percentage of the hams with little of interest to talk about make their QSOs short—merely repeating the same litany over and over for the rest of their lives. Give them their signal report and move on. They won't let you go without a signal report.

If you do have any success I expect you to write more than a nice two-page note. I expect an article so we can get more teachers suckered into following your lead. Poison their miserable little minds with the ham virus!

Your ESL groupies should really get off on shortwave, where they can fight off their immersion in English (except at home, presumably) for a few hours.

I have written.—Wayne.

PRODUCT REPORT RESULTS

The following is a compilation the Product Report cards we have received. Equipment is rated on a scale from 0 to 9, and the average rating for each product is shown. A piece of equipment is included in the list only if it has been rated by five or more readers.

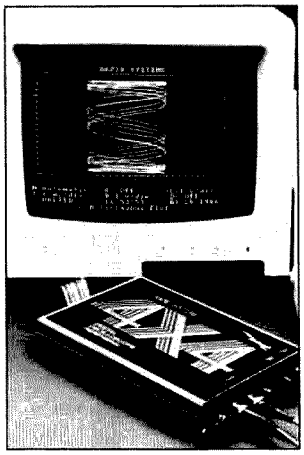
AEA PK-64	8.22	ICOM IC-27A	6.00	Kenwood TM-2550	7.00	MFJ 941C	5.66
Azden PCS-3000	7.00	ICOM IC-27H	7.75	Kenwood TR-2600A	7.84	MFJ 941D	7.50
Azden PCS-4000	6.00	ICOM IC-3200A	8.40	Kenwood TS-430S	8.36	MFJ 949C	8.33
Butternut HF6V	8.80	ICOM IC-37A	7.00	Kenwood TS-440S	8.00	Microlog AIR-1	8.33
Drake TR-7	7.86	ICOM IC-701	6.25	Kenwood TS-711A	7.75	TAPR TNC-2	7.00
Heath HW-101	6.40	ICOM IC-730	7.67	Kenwood TR-7950	8.00	Tempo S-15	8.00
ICOM IC-02AT	8.25	ICOM IC-735	7.22	Kenwood TS-830S	7.75	Yaesu FT-208R	8.33
ICOM IC-04AT	7.60	ICOM IC-745	7.88	Kenwood TR-9130	8.00	Yaesu FT-209RH	7.00
ICOM IC-2AT	8.42	ICOM IC-751	8.27	Kenwood TS-940S	8.77	Yaesu FT-757GX	7.88
ICOM IC-25A	5.75	ICOM R-71A	8.25	Kenwood TW-4000A	6.25	Yaesu FT-980	8.83
ICOM IC-251A	7.20	Kenwood TH-21AT	8.22				

NEW PRODUCTS

Number 21 on your Feedback card



Shure's 550L microphone.



The 4X4 digital oscilloscope from Rapid Systems.



Ameco is back with their Tunable Preamp Antenna.

NEW SHURE MIKES

Shure Brothers has introduced a new communications microphone to their line. The model 550L is similar in design to the well-known model 450, and is designed for base-station use. The mike is brown and silver and comes with an omnidirectional cartridge.

For more details, check Reader Service number 204.

RAPID SYSTEMS 4X4

A new digital oscilloscope peripheral for IBM-compatible computers has been announced by Rapid Systems. The 4X4, which retails for $1,995, features four channels of simultaneous sampling with a 32K data buffer on each channel. The A/Ds have programmable gains from 10 mV to 20 V per division, sampling rates from 0.1 Hz to 500 kHz, user-definable pre- and post-trigger buffers, and both analog and digital triggers. The menu-driven software includes a custom 140 x 288 color display, zoom from 1–2,000X, and a voltage cursor.

For complete details, mark Reader Service number 206.

SSB SQUELCH

A new voice-operated squelch module (VOS) has been announced by Naval Electronics. The VOS recognizes speech signals with a syllabic rate detector; when speech is present, the radio's speaker is turned on. The small board installs in most modern receivers and transceivers.

For more information, please check number 210 on the Reader Service card.

MIRAGE 1260 BEAM

A new yagi for 1260–1300 MHz is available from Mirage/KLM. The 1.2-44LBX provides 18.2 dB gain on a 12' 4" boom, with a wind load of only one square foot. Vswr is better than 1.5:1 over the specified bandwidth. The antenna requires no tuning and comes from the factory assembled and tested.

For complete details, check Reader Service number 203.

SAMS COOKBOOK

The third edition of the popular *IC Op-Amp Cookbook* by Walter Jung is now available from Howard Sams and Company. The book contains over 200 practical circuit applications, material on instrumentation amplifiers, information on chopper-stabilized drift-trimmed BIFETS, and an appendix of manufacturer's data sheets.

For more information about this and other Sams books, please check Reader Service number 205.

AMECO BRANCHES OUT

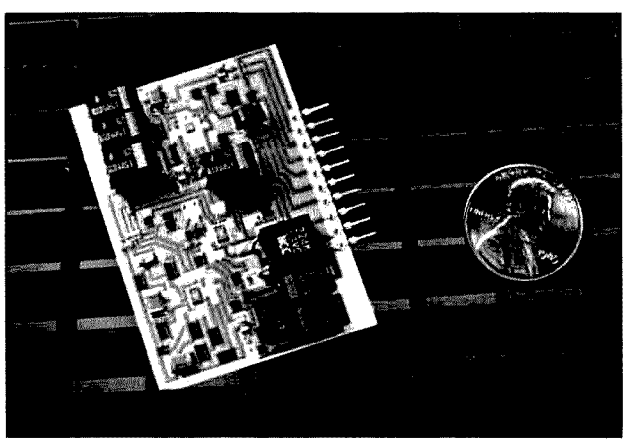
The familiar Ameco logo has resurfaced on their new Tunable Preamp Antenna. The TPA may be used both as a preamplifier or an indoor active antenna. The unit covers 0.22 to 30 MHz and uses a dual-gate FET for about 20 dB gain.

The TPA operates either on a 9-volt battery or an ac adapter (available for $7.50 from Ameco). The TPA, including a whip antenna, is $74.95. For complete details, mark Reader Service number 202.

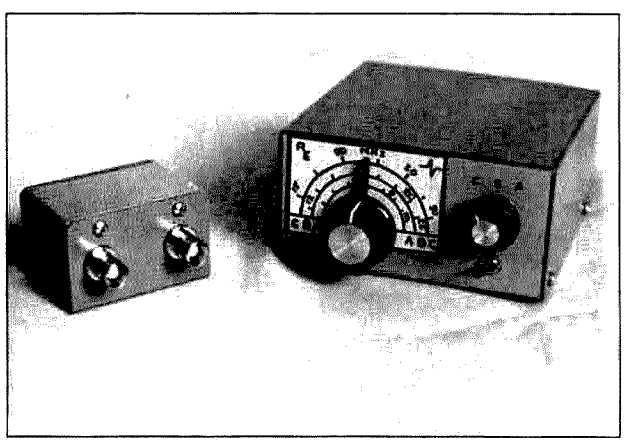
O-SCOPE FREQUENCY EXTENDERS

Radio Engineers has recently introduced two frequency extenders for oscilloscopes with low bandwidths. The HFX-1 contains an rf oscillator and a broadband mixing circuit to allow a 5- or 10-MHz scope to display signals of up to 55 MHz. The HFX-2 provides the same coverage when used with an external rf generator. Both units have an impedance of 50 Ohms and use BNC connectors.

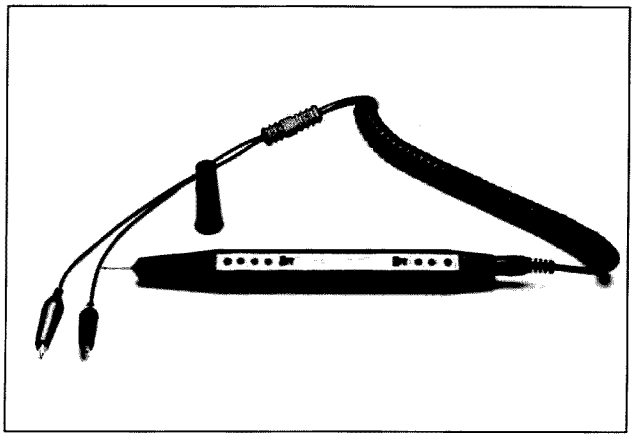
For complete details, please



Voice-operated squelch from Naval Electronics.



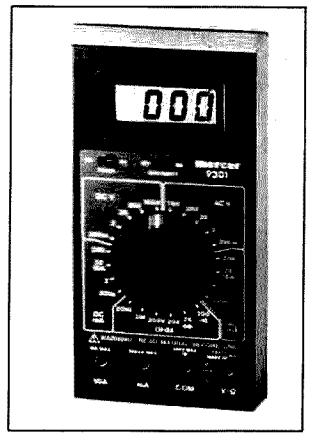
Radio Engineers' oscilloscope frequency extenders.



Davie Tech's PRB-50 digital logic probe.



The Regency HX1500 55-channel VHF/UHF scanner.



The Mercer model 9301 DMM.

check Reader Service number 208.

WINNER'S EDGE SOFTWARE

Winner's Edge Software has announced a new module for their Contester II computer-aided contesting system. The CQWW module is designed for use during the *CQ* Worldwide phone and CW contests. It keeps the operator up to date on contest statistics such as running score and the number of QSOs and multipliers (both in the contest and on the current band), as well as automatically logging contacts, duping, and even sending CW.

The CQWW module ($16.95) requires the Contester II Basic system ($39.95) and a Commodore C-64 or C-128. For more information, check Reader Service number 214.

DAVLE DIGITAL PROBE

Davie Tech's model PRB-50 digital logic probe tests the logic state of TTL circuits, as well as under- and over-voltage conditions in CMOS and other voltage-sensitive ICs. The unit indicates signals up to 50 MHz and has a pulse width sensitivity of 10 ns. The probe operates on from 3 to 18 V dc.

For complete details, check Reader Service number 211.

XCELITE STRIPPER

Xcelite is now marketing an automatic coax-stripping tool which removes outside insulation, braid, and dielectric simultaneously or one at a time. The unit handles RG-178 up to RG-6 with color-coded cassettes which slip in and out of the tool in seconds. Pre-adjusted models are also available for single-size applications.

For more information, please check Reader Service number 212.

REGENCY HX1500

Regency Electronics has announced the HX1500 55-channel hand-held VHF/UHF scanner. The HX1500 covers 29–54 MHz, 118–174 MHz, and 406–512 MHz. Stored channels may be grouped into any of four banks for ease of access—all of the police channels in one bank, repeater pairs in another, and so on. Other features include dual scan speed, a priority channel, scan delay, and direct channel entry from the sealed keypad. The HX1500 retails for $369.95.

For complete details, mark number 213 on the Reader Service card.

MERCER 9301 DMM

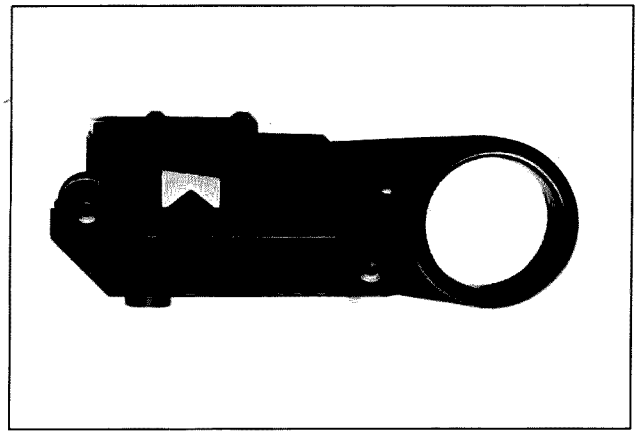
Mercer Electronics, a division of Simpson, is now offering the model 9301 DMM ($69), a 3-1/2 digit general-purpose instrument with 0.25% accuracy on all dc ranges. It measures up to 1,000 Volts dc, 750 Volts ac, 10 Amps ac or dc, and 20 megohms. Resolution is 100 uV, 0.1 uA, and 0.1 Ohm. Other features include an audible continuity checker, a diode test position, and a battery life of 2,000 hours.

For more information on this and the entire line of Mercer products, check number 207 on the Reader Service card.

FREE HEATH CATALOG

The new Heathkit catalog is now available. Completely redesigned, this edition includes many new kits, as well as a line of beginner's kits priced at less than $5.

For your free copy, check Reader Service number 209.



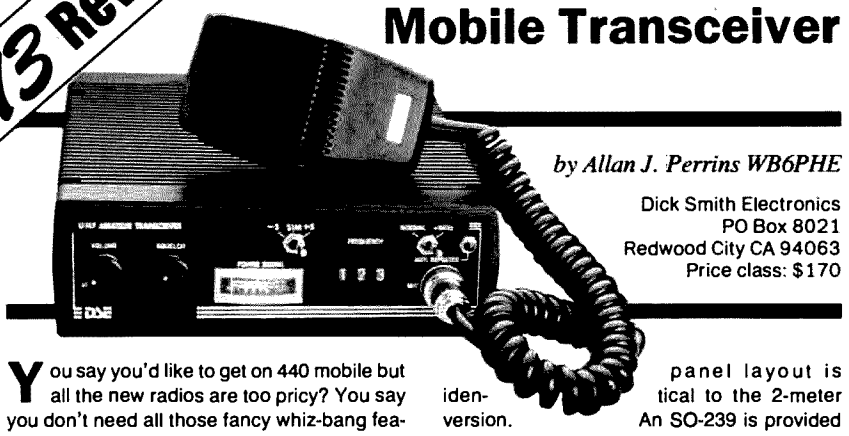
Xcelite's new coaxial stripper.



Free catalog available from Heath.

73 Review

Dick Smith 440-MHz Mobile Transceiver



by Allan J. Perrins WB6PHE

Dick Smith Electronics
PO Box 8021
Redwood City CA 94063
Price class: $170

You say you'd like to get on 440 mobile but all the new radios are too pricy? You say you don't need all those fancy whiz-bang features like scanning, programmable offsets, priority channels, and memories? Well, how about a good, basic, no-frills radio for less than $170. There is a catch—it's a kit.

Dick Smith Electronics has introduced a 440 companion to their popular 2-meter kit. This is a newly designed radio, not just a retrofit of their Australian model (they use 430–440 in Australia).

Full coverage from 440 to 450 MHz is provided in 5-kHz steps with a switch for ±5-MHz transmit offset or simplex operation. Also provided is a momentary push-button labeled "Anti-Repeater" that allows you to monitor the repeater's input frequency to see if you're within simplex range. Ten Watts of power out is nominal; typical receiver sensitivity is around .4 uV or better.

The kit comes complete with a mobile mounting bracket and a standard microphone. An optional 16-button DTMF microphone will be available soon. A matching base-station power supply is also available (K-6310—$39.95).

No provision was made for subaudible tone (PL) but a modification to add it will be outlined in the construction part of this review.

Appearance

The front and rear panels are die-cut from PC board, painted, and silk-screened. Front-panel layout is identical to the 2-meter version. An SO-239 is provided on the rear panel for the antenna connection, but purists may wish to replace it with an N connector. There is also an external speaker jack. The case is the same as the 2-meter kit—black plastic with an adjustable mounting bracket. The microphone provided, although comfortable and stylish, is internally baffled and designed to be a "communications" type with very limited response. More on this later.

Circuit Analysis

Don't worry, I'm not going to get complicated. Refer to the block diagram (Fig. 1) and follow along. By the way, a detailed theory of operation is included in the manual, which helps in troubleshooting.

The synthesizer is a modification of a basic PLL. The reason for this is that it is not practical to divide a binary number corresponding to 440 MHz directly. Instead, an offset oscillator is used so that the difference between the vco output frequency and the offset oscillator will be divided by a selected number (front-panel thumbwheels) and then compared to the reference oscillator in the PLL phase comparator. In this case, a 10.24-MHz oscillator is divided by 2,048 to give a reference of 5 kHz. The resultant error voltage is used to "steer" the vco to the proper frequency output.

The vco operates at a nominal 220 MHz. It is doubled to provide a 420-MHz signal, which is used in the receiver as the first i-f. Antenna input to the receiver passes through a two-section helical resonator, then enters an rf amplifier. From there a second two-section helical resonator feeds the mixer, where the input signal is converted to 21.4 MHz. A single IC performs the second i-f functions as well as squelch. A conventional audio amplifier drives the speaker.

In the transmit mode the same vco signal is also doubled to 440 MHz and is bandpass-filtered by yet another two-section helical resonator. This removes any trace of the 220-MHz vco signal from the output. The signal is then amplified to approximately 300 mW to drive the power amplifier module to a nominal 10-Watt output.

Microphone audio is amplified and limited, then a sample of audio is routed to a varactor diode in the vco circuit to produce FM.

Diode switching is used in the antenna filter network to handle the T-R chores.

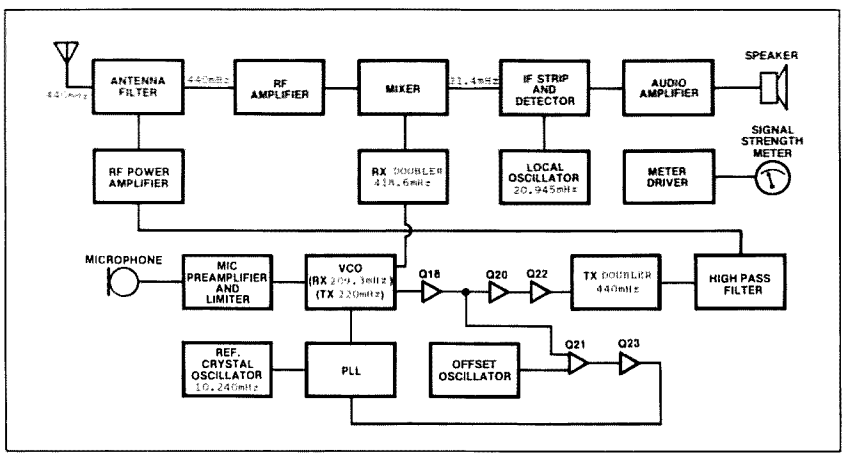


Fig. 1. Block diagram of the DSE 440 mobile rig.

Construction

As the Dick Smith ad states, "This kit is for advanced builders only!" And, I might add, not for the timid, either. When your kit arrives, you will find lots of bags of parts. Forget your preconceived "Heathkit" notions of parts being in coded bags—these aren't. Of course, you're also not paying someone to put those parts in the coded bag, either. If you're a little slow with resistor color codes now, you won't be by the time you finish this kit.

Many of the coils will have to be fabricated by the builder. This really isn't as hard as it sounds. Just use a drill bit of the proper diameter as a winding form. Take your time and refer to the drawings in the manual. When mounting the coils, keep the leads short.

This is a complicated kit and component layout is rather dense, so before you start construction I suggest that you read the manual from cover to cover three times. Be sure to read the errata sheet as well. It contains additional information on construction and alignment. When you finally get the soldering iron warm, repeat to yourself "take your time, do it right" ten times aloud. If you are not sure where a part goes, skip it for the time being and go back to it later when the rest of the parts in the area have been installed. Remember to check off in the space provided the parts you have installed. Don't forget to install all the jumpers (they're called "links") shown on page 54 of the manual.

If you choose to socket the DIP ICs, be sure to use a very low profile socket for IC2, as it is directly under the front-panel thumbwheel assembly. I didn't, and ended up having to change it later when I tried to mount the front panel.

Speaking of the front panel, the instructions are on page 55 of the manual and the wiring is on page 66. Same thing with the back panel—instructions on 56, pictorials on 55 and 67. I found this a bit inconvenient. The manual for the 2-meter rig was much better in this regard. DSE informs me that the second printing of the manual will have these pages rearranged to be less confusing.

Only tack-solder the front and rear panels

until all alignments have been completed and the unit has been fully checked out. I made that mistake as well, and desoldering one of those panels was not fun. While on the subject of front/rear panels, if you need more than one PL frequency, you might want to add a stereo mini-jack on the rear panel for an external encoder. Of course, you could always cheat and use the external speaker jack—as I did.

And speaking of PL, the place I injected tone was the junction of R22 and R23. The wiper of the deviation pot could also be used. Use a piece of shielded cable to connect to the rear-panel jack. If you need only one PL frequency, secure the encoder (using double-sided tape) to the inside of the same case half as the speaker and connect it using shielded cable. Switched TX voltage can be taken from either side of R149.

Alignment

The alignment instructions are very good and no problems should be encountered, assuming the unit was constructed properly. Presetting the small red variable caps can be a little tricky, so pay close attention to the drawing in the errata sheet. You should be able to attain reasonable receiver sensitivity doing the adjustments with a weak over-the-air signal, but alignment using a signal generator is preferable if you have one available. My unit ended up at .3 uV for 12 dB Sinad, which is more than good enough for repeaters.

Transmitter alignment should not be attempted with a dummy load mounted on the back of the radio! Rf will leak back into the radio and will interfere with PLL adjustments. Locate your dummy load about three feet away and you won't have any rf feedback problems. Be sure to perform the broadband transmitter alignment (page 64 of the manual) carefully and don't forget the additional step included in the errata sheet. If you do it right, the power should be just about flat from 440 to 450. Mine made 12 Watts across the band, and the spectrum analyzer showed no spurious signals at all. Not bad!

I would suggest waxing the vco area before trying to adjust deviation, as the vco tends to be just a little harmonic before you "pot" it. An easy way to melt wax is to place it in a tablespoon and heat it over an electric stove burner. Don't use gas—remember that wax burns. Be sure that the vco shield is close to the PC board or you'll have leaking hot wax all over the board. A shield of double-sided PC board above and below the vco housing also helps.

Transmitter modulation should be done last. You may find that even when you get the deviation adjusted for 5 kHz, the radio still sounds "loud." I suspect that this is because the microphone amplifier is the same as the one in the 2-meter radio, whose vco output is not doubled. There are several changes suggested in the errata sheet that will improve the loud sound and compensate somewhat for the "communications" type microphone.

Operation

Frequency selection is handled by push-button BCD switches on the front panel that are much better than the ones in the 2-meter kit. These have a very smooth feel to them and are easy to use, even in a mobile environment. Receive audio could use a little more "punch." Modifying the amplifier for a little more gain would help, as does an external speaker. Adjacent channel rejection is very good and the unit does not seem to be susceptible to intermod.

On-the-air reports of transmit audio ranged from "tinny" to "thin and hollow," although I found one guy who thought it sounded just fine. The mods in the errata sheet will help, but the big culprit is the microphone. One report said it sounded like the two-way radio in "Adam 12," and that is what is referred to as "communications quality." I suppose it's a matter of personal preference, but I like my audio to sound better than that. An old microphone from the junk box made a major improvement. My understanding is that DSE is researching other microphones to replace the one presently supplied.

Summary

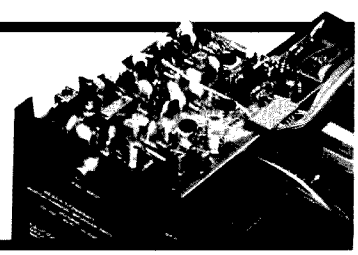
This was a fun kit to build, though the experience gained in building the 2-meter kit previously was an advantage. It's not a fancy radio, but I don't need a fancy radio and a fancy price tag. Since I built it myself, I suspect that I can also fix it myself should something ever go wrong. That would be hard to say about any of the "rice rockets" that I've seen lately.

This 440 rig delivers excellent value for the price: an adequate output power level and a suitably sensitive receiver. Mobile operators may find that a little extra filtering may be in order if the power leads aren't run directly to the battery. I had problems using the cigarette lighter plug in my Buick—too much hash, especially with the air conditioning blower on. Running leads directly to the battery eliminated all but a little alternator whine, and I can live with that. I defy you to find another new, fully synthesized, UHF mobile radio for $170.■

Heath HOA-5404-1 Pan Adapter

by Marc Stern N1BLH

Heath Company Dept. 011-442
Benton Harbor MI 49022 Price class: $100



Building the Heathkit HO-5404 Station Monitor without the Pan Adapter module (HOA-5404-1) is like making toast without butter—it will work, but it just won't be right.

Imagine trying to use a monitor scope to tune in a weak CW signal near your frequency—but without a Pan Adapter. You may be able to do it by watching the trace of the pattern generated by the scope's internal sawtooth generator, or you may be able to do it with the RTTY setting. But if you do, you'll be very lucky because you still really won't have any idea where the signal is in relation to yours and you may actually tune in a different, slightly stronger signal than you had wanted. The result could easily be some missed rare DX because you tuned to the wrong signal.

A Pan Adapter module would eliminate this. Because it interfaces directly with the i-f strip of your receiver or transceiver, any signals within the i-f passband will be indicated on the Pan Adapter's display trace. With the Heathkit HOA-5404-1, any signals within about 100 kHz of your frequency will appear on the trace. The frequency you are on is indicated in the center of the scope's graticule, and signals below and above it are on either side.

With the Pan Adapter module installed, you would be able to match your frequency to that of the station you are attempting to contact and establish contact.

The Pan Adapter module is also invaluable in another way. Let's say someone is QRMing your signal. The Pan Adapter module would indicate where the offending station was in relation to yours, and you would then be able to turn your beam—providing you have a beam for that band—and get a heading on the offending station.

Of course, even if you didn't have a Pan Adapter module installed in your scope, you would still be able to use the scope quite handily for monitoring phone signals and RTTY and checking transmitter performance. But the Pan Adapter adds a great deal of capability.

A one-board project, the HOA-5401-1 is meant to be installed within the HO-5404 Station Monitor Scope. Provisions are made for its installation on the upper right rear of the chassis (looking at the scope from the front). The Pan Adapter interfaces with the monitor scope's circuit board through three connector pins, which bring voltage to the board.

A multi-colored, multi-conductor ribbon cable interfaces the module with the switches at the front of the scope. Be careful when you prepare the ribbon cable to cut it exactly as the instructions note. The reason precision is needed is that the cable must bend at a 90-degree angle so that it can fit into the edge connector. If the cable isn't cut correctly, it won't seat correctly with the edge connector pins on the circuit board.

As you would expect with Heathkit products, there's very little left to the imagination. Everything is arranged logically and the instructions follow suit.

Like nearly every modern Heathkit, the transistors, capacitors, integrated circuits, resistors, chokes, and anything else needed are arranged logically in the box. Parts are stored

in separate modules until you reach that particular step.

Even with this type of organization, working slowly will ensure that the kit will go together and work correctly on the first try. But if it doesn't, you can easily work back to the point where you made your mistake by simply retracing your steps.

For example, I found that after I'd assembled the project it wouldn't fire correctly. As I went through the troubleshooting routines, I found one of the key transistors wasn't working—no voltage—and I substituted my own for it. This cured one problem and I thought I was on my way, but the adapter hid a second, much more frustrating problem that resulted in several long-distance calls to customer assistance. In fact, the Pan Adapter ended up back in Benton Harbor. The reason it did will become apparent shortly.

As you work with the oscillator section of the board, you soon realize that the key circuit is the one containing transistor Q310. It is the crystal oscillator circuit, which operates at a frequency of 3.395 or 8.830 MHz. These frequencies cover many of the major rigs on the market. This circuit places the Pan Adapter's pip on the screen at the tuned frequency and tells you where your rig is tuned in relation to others.

As you're building this section, you run into a couple of capacitor insertions that look puzzling. Instead of two holes, there are three and you are instructed "to use the holes that best fit the capacitor supplied with your kit." Evidentally, this instruction is incorrect because I couldn't get the oscillator section to oscillate, although I used the capacitor supplied and used the "holes that best fit."

So, after about a week of troubleshooting, I sent the kit back to Benton Harbor. On its return, the technician who worked on it informed me my choice of capacitor holes was incorrect. Since this is the case, I would urge Heathkit to correct the documentation and instructions.

Another troubling error occurred in the information sheet describing the intermediate frequencies of various transceivers. As you look at the listing for Kenwood—the Pan Adapter was set up to work with a Kenwood TS-520SE—you notice something interesting: Just about all the i-f frequencies are listed as 8.830, except the 520. And, as most people know, the 520 was a less expensive version of the 820 and one would wonder why essentially the same rigs would have two differing i-f's. It doesn't make much sense, does it?

I thought so, too, and I explored the schematic thoroughly and came up with the conclusion that the Heath information sheet was wrong. I'm happy I took the time to do the detective work beforehand; with the amount of componentry on the printed circuit board, it would have been a job to desolder the components needed for the 3.395-MHz i-f and insert the new components.

In more than five years of having built various Heathkits, I haven't run across such a glaring error before, and I would urge Heath to check documentation more closely before it gets a final approval.

And, speaking of the documentation, it took me more than an hour to make all the changes needed to update the manual to reflect new components. It probably would have been easier for Heath to rewrite the brief manual, rather than rely on the buyer to do it.

That buyer had better be an intermediate level kit builder because the Pan Adapter is definitely not a kit for beginners. You have to build the Monitor Scope first and make sure it is aligned before building the Pan Adapter. But, like all Heathkits, the builder is led step by step through the building process with explicit detail.

In operation, the scope and the module work very well together. I was able to find signals and move over to them very easily. It also helped me find a clear frequency quite easily, which isn't easy on 20 meters these days.

It is actually simple to use and merely takes pressing three buttons—two at the same time—on the front of the scope to fire up the Pan Adapter. Simply pushing SSB, RTTY, and 100 kHz swings the Pan Adapter into action. There's a marker pip that indicates where you are in relation to the other stations in the passband of your radio.

Be aware, though, that you have to connect the module to the i-f of your transceiver or receiver. It's easy to do and Heath supplies the decoupling capacitors and instructions on how to do it. They also supply the miniature RG-174 coax to make the connection.

In the final analysis, the Heathkit Pan Adapter module is a worthy addition to the HO-5404 Monitor Scope. In fact, I think it should be included as part of the whole kit, rather than being an extra cost option at $99.95. Without it, the kit is like dry toast. It's filling, but isn't nearly as good.

Reader Service number 201.■

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Just the FAX, Ma'am

Answer ham radio's most popular question in agonizing detail with this complete one-chip weather facsimile system for your Commodore 64. Next month: Using your C-64 to control the weather!

My article "One-Chip Facsimile" (December, 1985) has kept a good number of Atari owners glued to their terminals, watching the weather. It soon became apparent that Commodore 64 owners were feeling a bit miffed at being left out of the fun. I bought a C-64 and modified the program to work with the new system; the result is this article.

What It Can And Cannot Do

This system will receive facsimile signals and display the received charts on the computer's monitor or TV screen in a space roughly two displays wide and three displays long. A joystick is used to scroll the screen around the chart. The received charts may be saved on disk or printed.

The system will properly display facsimile signals sent at a rate of 120 or 60 lines per minute (lpm). These rates (particularly 120 lpm) are used by most commonly heard stations.

Number 1 on your Feedback card

The computer samples each received line 480 times, and can display 512 lines horizontally. While this resolution can give good results, it is less than 50% of the resolution transmitted and gray tones are not used. Thus this system is more suitable for high-contrast, large-format weather charts than for satellite pictures and similar charts with much fine detail.

Figs. 2 through 4 are samples of charts that I have received at my location, and are representative of the system's capabilities.

System Components

The components of this system are: a good quality communications receiver with SSB capability, a simple tone-detector circuit, a Commodore 64 computer system, and a pair of computer programs, named Visifax and Utility.

Receiver Requirements

The receiver that you use should be a stable, good quality, general-coverage receiver with SSB capability. If your receiver provides acceptable ease of tuning and frequency stability for SSB voice signals, it should be usable for facsimile reception. I have used a Yaesu FRG-7 and a Sony ICF6500W with good results.

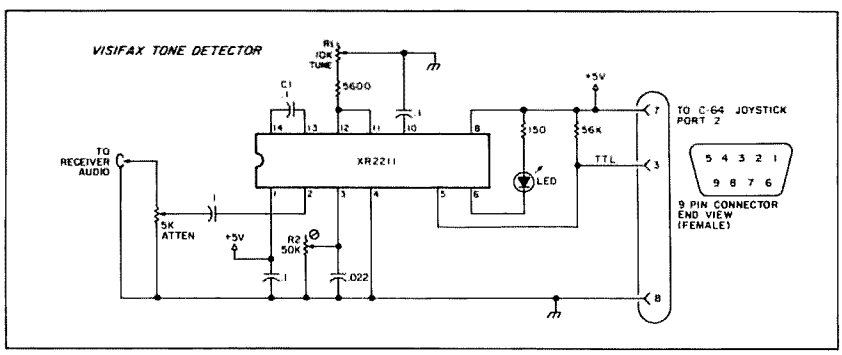


Fig. 1. Tone-detector schematic—one chip is all you need to display weather facsimile on your C-64.

The Tone Detector

The tone detector is a simple circuit that connects between the receiver audio output and joystick port 2 of the computer. The detector converts the facsimile tones to TTL pulses that the computer can use. The circuit, shown in Fig. 1, is based on the XR-2211 tone detector. R1 and C1 determine the detector's frequency, and R2 is used to adjust for the sharpest detail as a chart is being received. The LED serves as a simple but effective tuning indicator. The 5-V power source is supplied by the computer.

Most parts may be obtained from local outlets. The XR-2211 IC may be obtained from several mail-order parts suppliers (Jameco, Digi-Key, JDR Microdevices, etc.). The construction methods used are not critical.

The Computer System

The Commodore 64 computer and the two programs are the heart of the system and control all aspects of reading and displaying facsimile charts. This system is not usable on the VIC-20 computer because of memory requirements and other computer differences. A disk is required for program loading and (optionally) to hold received charts. An optional graphics dot-matrix printer may be used to produce a hard copy of the received chart; one was used to produce Figs. 2–4.

The Visifax Program

The Visifax program reads the tone detector's output signal at joystick port 2 and displays the received chart on the computer's monitor. Various options are available for the user to control the receiving process. The program is written entirely in assembly language; it is not shown here because of its length (about 25 pages). It is a complex program that uses several of the Commodore 64's sophisticated capabilities to do the job at hand.

The Visifax display consists of two lines of titles at the top and two lines at the bottom to enter controlling commands. The third line from the bottom contains one of two messages to aid in the command selection. The middle portion of the display consists of the received chart.

Because the C-64 uses the same circuitry to read the joystick ports as is used to scan the keyboard, it is difficult to use the joystick ports and keyboard simultaneously. Thus a standard joystick plugged into joystick port 1 is used to totally control the Visifax program once it is running. Upon ending Visifax, it is important to unplug the tone detector and joystick before attempting to use the keyboard. Failure to do so could result in a partial system lockup, but it will not damage the computer in any way. Should this occur, reset the computer by pressing and holding the RUN/STOP key and then striking the RESTORE key. The display will clear but memory will not be disturbed, and you may then key in whatever you desire.

Visifax Commands

The two bottom lines of the Visifax display contain eight commands. The one that you may direct the computer to respond to next is highlighted in green (gray with a monochrome monitor). Moving the joystick will allow any of the commands to be highlighted. Pressing the joystick's FIRE button will cause the highlighted command to be performed.

RESET

This command will start the process of displaying a chart. The chart is displayed as received from left to right and from bottom to top (so most charts are viewed normally...without your having to stand on your head!). The portion of the chart that is visible on the display is automatically set to the lower left corner. Subsequent RESET commands will reset the displayed chart to the left of the screen without altering the synchronization.

SYNC

Each SYNC command will have the effect of displaying subsequent received lines down the display about one half inch. This command should be used as required to center the received chart properly. Most stations precede charts with a short period of synchronizing lines that may be used for centering.

SKIP

Each SKIP command will increment the number of received lines to skip between displayed lines. This feature will allow compressing the received chart horizontally, fitting more of it onto the computer's screen. From 0 to 9 received lines may be skipped between displayed lines. I find that a skip value of 1 is used most often.

MODE

The MODE command will step through the three possible modes of operation, with the present mode shown next to the word MODE. Mode ONE indicates that the chart will be received and the process will be complete when the right-most line is displayed. Mode CONT allows the continuous display of charts, with one overlapping the last. Mode WAIT halts the display of any more received lines but does maintain synchronization. This feature may be useful to eliminate unwanted sections of a known chart.

CLEAR BUFFER

Selecting this command will simply clear the buffer that holds charts as they are being received, and thus it will clear the computer display.

SCROLL

This command is used as desired to control which portion of the received chart is being displayed. (As mentioned, the received chart is about six times the size of the display!) Selecting this command will change the message on the third-from-the-bottom display line from PRESS JOYSTICK BUTTON TO SELECT COMMAND to USE STICK TO SCROLL, BUTTON TO DISPLAY.

Now repeatedly bump the joystick in the direction of the chart that you wish to view. A pair of numbers (hexadecimal, and of the form row:column) next to the word SCROLL will indicate the portion of the chart that will be displayed. Row numbers range from 0 to 28. Column numbers range from 0 to 18. The lower left corner of the chart is at row 0,

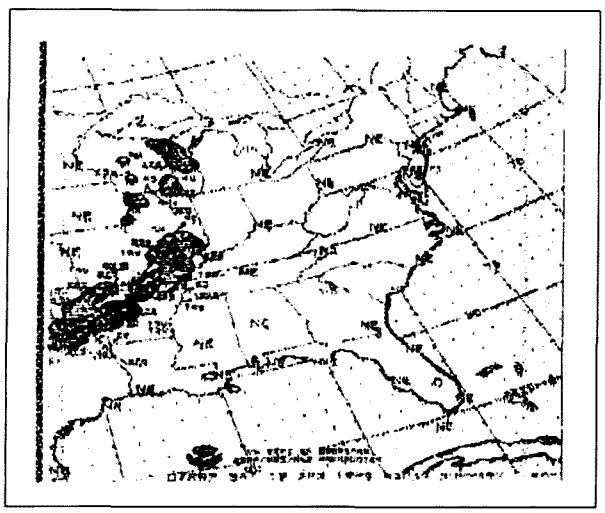


Fig. 2. A radar summary chart received from NAM on 3.357 MHz.

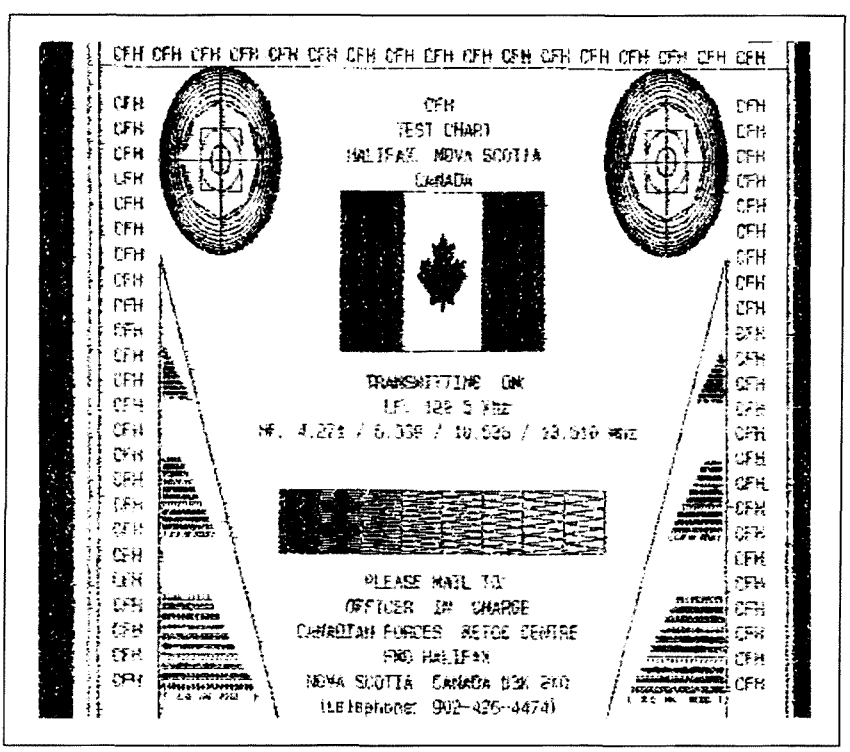


Fig. 3. This test chart was received from CFH on 6.330 MHz.

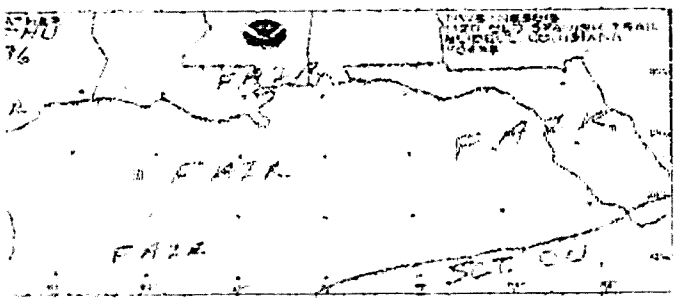


Fig. 4. A chart received from WLO on 6.852 MHz.

column 0. After obtaining the desired row and column numbers, press the joystick button to update the display to this portion of the chart. The joystick may now be used as desired to select any further command.

LPM

This command may be used to choose which basic receiving rate (in lines per minute) is to be used. Values of 120 or 60 are possible. Most commonly heard signals will utilize a rate of 120 lpm.

QUIT

This command may be selected when it is desired to leave the Visifax program and return control to Basic. Please recall the earlier note about the incompatibility of the simultaneous keyboard and joystick port usage. When you use this command, the last chart received is maintained in a buffer in memory. (It is lost if you turn off the power!) The Utility program can print it or move it to disk. *Running any program other than Utility will destroy the chart.*

The Utility Program

Utility is required to provide several auxiliary functions, including:

- Loading the Visifax program
- Making a backup copy of the Visifax program
- Starting up Visifax
- Saving a chart to disk
- Loading a chart from disk
- Printing a hard copy of a chart from memory

It is a relatively short program that is written in Basic. The user controls its operation simply by selecting an item from a menu by pressing a single key. Utility is started by keying in the following two commands: LOAD "UTILITY",8 and RUN.

Program Visifax is loaded from disk to memory automatically when Utility first begins operation. This is required because Visifax actually assists Utility in most operations.

A backup copy of the two programs should be made on a second diskette for safekeeping (format it ahead of time). With the Utility program in memory (but not running), you may make a backup copy by issuing the command: SAVE "0:UTILITY",8. To save a backup copy of Visifax, run the Utility program and simply select the SAVE VISIFAX PROGRAM menu item.

Two menu options are available to start up Visifax—with and without clearing the received chart memory buffer.

Two menu options are available for saving a chart from memory to disk and from disk to memory. An empty diskette will have room to hold the two programs and four charts, with about 100 blocks left over for whatever you like. It will require one and one half to two minutes to save or restore a chart. A chart that has been restored to memory from disk may be viewed by starting up Visifax. (Omit the buffer clear option!)

The final menu option will print a hard copy of the memory resident chart on an attached Gemini 10X dot-matrix graphics printer (via a CARDCO G-WIZ printer interface). Since Utility is written in Basic, printing a chart is not a speedy operation. It will require 15 minutes. However, since Basic is used, this portion of the program may easily be modified for usage with similar printers. The program contains enough remarks to get you started.

Using the System

Turn your computer system on and load and run the Utility program. Select menu option 5 to start Visifax.

Fire up your receiver and then connect its audio output to the tone detector's input and the tone detector's output to joystick port 2 on the computer.

Tune in a strong facsimile signal until its characteristic screech-screech sound is of a medium pitch. Then adjust the detector's TUNE control until the tuning LED blinks in time with the audio. A moderate level of receiver audio output will be required.

Use a joystick connected to joystick port 1 to select the RESET command to begin the process of displaying a chart. Use the SYNC and RESET commands as required to properly position the chart vertically on the display. Fine-tune to get the sharpest picture.

The SCROLL command may be used at all times to scroll the received chart around the display.

To save or print a received chart, unplug the tone detector first, then select the QUIT VISIFAX command. Using the keyboard, load and run the Utility program and select the SAVE A CHART TO DISK or PRINT A CHART menu item.

Getting the Programs

For a fee of $10 to cover my expenses, I will send you a diskette containing the Visifax and Utility programs, a reprint of this information, and other various notes. Be sure to request the Commodore 64 version.

If you would like to understand better how Visifax works or how to make modifications to it, I can include printed listings of the programs and the assembler source code file for an additional $5. EDITOR64 and ASSEMBLER64 were used for program development. Note that you may modify the Utility program without this option.

I cannot accept any CODs or credit cards. The package is available from me at the address given at the beginning of this article.

A tape-based version of these programs can probably be developed. Write me if you desire a tape version (but send no money). If there is sufficient interest, I will develop it and inform you of its availability. ■

WHERE TO TUNE

By far the best facsimile signals at my location are from the Naval Eastern Oceanography Center (NAM) on 3.357, 8.080, 10.865, 16.410, and 20.225 MHz. Weather charts and satellite photographs of all types are broadcast nearly continuously.

Canadian station CFH out of Halifax, Nova Scotia, on 4.271, 6.330, 10.536, and 13.520 MHz also transmits interesting weather charts. CFH usually broadcasts one or two charts for the first 15 to 30 minutes of each hour.

Coastal station WLO broadcasts on 6.852, 9.1575, and 11.145 MHz with information that covers the entire Gulf of Mexico area. The current schedule consists of various charts starting at 0250, 0850, 1440, 1800, and 2000 UTC.

Coast Guard station NMF offers a similar service on 3.242 and 7.530 MHz that covers the northeastern coastal area. Scheduled times are 0530 and 1730 UTC.

Listed frequencies for San Francisco (I have heard a few) include 4.346, 8.682, 12.730, and 17.151 MHz. Honolulu possibly uses the frequencies 4.803, 9.440, 13.863, 16.398, and 21.785 MHz. I have copied this station only briefly.

Luis E. Suarez OA4KO/YV5
Apartado 66994
Caracas 1061-A
Venezuela

Make the Switch to PIN Diodes

Many of us have older rigs which just can't handle QSK. Here's how to replace your relays with solid-state switches.

Number 2 on your Feedback card

It's getting very difficult to find decent replacement relays for old transceivers. Who wants to pay $45 for a relay when you know that it will need to be replaced almost as soon as you put it in? Or maybe you're just tired of cleaning the silly things. This article will show you how to replace the relay in your transceiver with a faster and more reliable solid-state switch.

Believe it or not, the easiest part of this modification is antenna switching, and it doesn't matter if you put out a milliwatt or a kilowatt. On the other hand, the circuit for dc switching requires a lot of planning and thinking—but you'll find that it is worth the time and effort it takes.

Let's Switch

Fig. 1 shows the basic configuration of a typical switching circuit used in old transceivers. The basic requirements in those days were:

1. Switch B+ from receive to transmit and back.
2. Toggle the antenna from receiver to transmitter.
3. Change the speaker from an output device to an input device, or just disable the speaker.
4. Handle any additional circuit requirement like switching bias, selective signaling, accessories, etc.

Requirement number three may sound unusual to newcomers. Speakers used to be employed as dynamic microphones when the equipment was in the transmit mode, despite their bassy sound. Some cheap (and not so cheap) intercoms use a similar procedure today.

Modern relays are rated at several million operating cycles. Unfortunately, they often fail after only several thousand cycles of operation. In heavy-duty operation, such as the dispatching of taxis, the rated specification is not applicable.

The New Approach

During the late 60s and early 70s, better and more reliable power transistors were already available for use as dc switches in the 5–10-Amp environment. Most equipment was designed for 13.8 V dc, so the power was handled very easily by these devices. Yet the most economical method of VHF/UHF antenna switching in the 2–50-Watt range was still the relay. In addition, a single or twin relay was about the same size as its transistorized equivalent, so using semiconductors saved no space.

The PIN Is Here

Vacuum-tube diodes were used for many years after solid-state devices became available (my Heath SB-100 uses a tube for avc and solid-state diodes for other functions). Then the PIN diode appeared. At first, PIN diodes were used only in VHF and UHF hand-helds, state-of-the-art (expensive) equipment, and military radios. The advantages of the PIN became evident, and it quickly became a common part of all radios, regardless of power or frequency. Despite this popularity, the behavior of the PIN is still not widely known. Let's shed some light on the subject.

First, we'll look at the characteristics of the PIN diode, then we'll see how it works, and finally we'll explain how to design a practical circuit. The characteristics are:

- It does not rectify the applied signal.
- It does not generate harmonics.
- Once forward-biased, it offers a fixed resistance path (R_S).
- Its capacitance (C_T) is constant regardless of the applied bias at VHF and above frequencies.

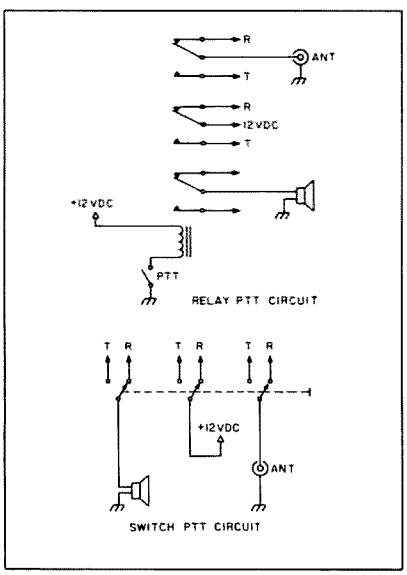


Fig. 1. This is the switching arrangement you'll find in most older transceivers.

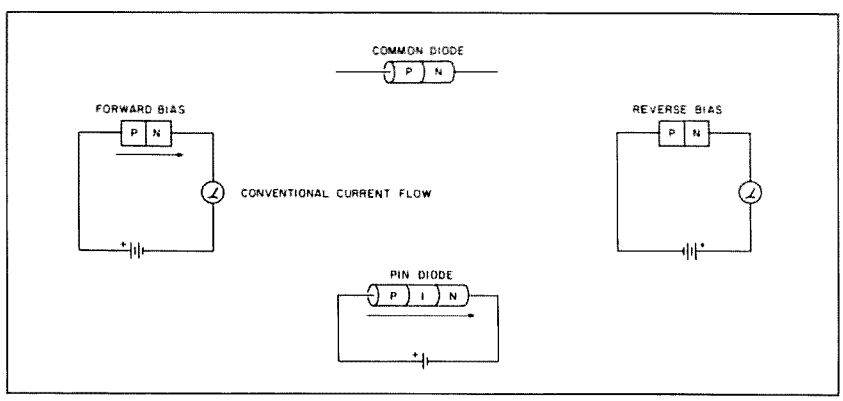


Fig. 2. The PIN diode could be called a current-controlled resistor at rf. The high-resistance intrinsic or "I" region is what sets the PIN apart from a normal silicon diode.

- It may be used from below 500 kHz up to several GHz, depending on the model.
- Its insertion loss is very low.
- It supplies a high degree of isolation.
- Its switching speed is very high.

What Is a PIN Diode?

The PIN diode is better described as a current-controlled resistor at radio and microwave frequencies. The difference between a common diode and a PIN diode is that the common diode is made of a semiconductor with P dopant in one side and N dopant in the other side (see Fig. 2). As a PN junction, the PIN is developed with the special property of easily conducting current in one direction (forward bias) while impeding current flow in the other (reverse bias). Current flows when the anode is positive and the cathode is negative. The PIN diode is made like a common diode except that a high-resistance I-region is sandwiched in between the anode and the cathode.

See Fig. 3. When the PIN diode is forward-biased, the current does not flow immediately through the I-region. It takes some time to do so. In that tiny moment, a charge is stored in the I-region, lowering its resistance to a value known as R_S. When the diode is zero-biased there is no storage charge in the I-region and the diode appears as a capacitor. This characteristic is known as C_T. The storage time is long enough so that the PIN diode cannot rectify at very high frequencies. The alternating rf current changes from plus to minus faster than the I-region allows conduction. In other words, a charged particle needs some six microseconds to travel through the I-region, which is quite a long time for any frequency period above 20 kHz.

The most common use of PIN diodes is as a switch at rf—although they are used as modulators, rf attenuators, and phase shifters up into the GHz region. Don't try to use them as detectors or to rectify an i-f signal in an agc circuit. Also, don't use them to generate harmonics from your crystal markeroscillator—it just won't work.

Switching Circuits Using PIN Diodes

There are two kinds of basic circuits using PIN diodes as switches. One is the series-connected single-pole, single-throw (SPST) switch and the other is the shunt-connected SPST switch. Both are shown in Fig. 4. The series-connected diode, when forward-biased, produces a very low insertion loss over a broad frequency range. Typically, the average insertion loss is around 0.1 dB. When

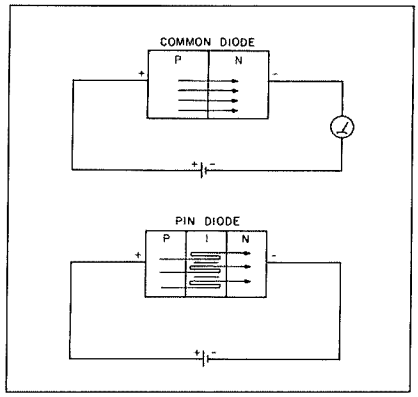


Fig. 3. The I-region is the reason a PIN diode does not rectify an rf signal.

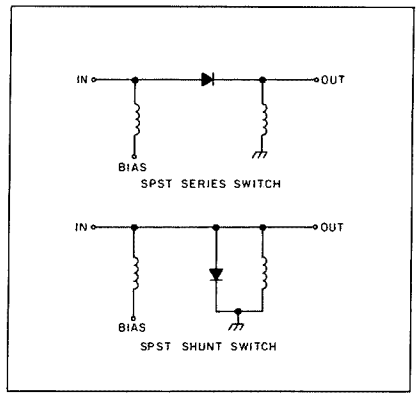


Fig. 4. These are the two basic switch configurations.

reverse-biased, the diode impedance is very high. The average isolation is 25 dB for frequencies between 10 MHz and 2 GHz, with typical values between 15 dB and 60 dB. When shunt-connected, the PIN diode has almost the same figures for insertion loss and isolation.

The insertion loss in series-connected diodes depends on the R_S value and has a linear proportional response. The higher the R_S value, the higher the insertion loss. Typical R_S values are from 0.1 Ohms to 10 Ohms. The isolation depends on the C_T value and is also related to frequency. In this case, the higher the frequency and the higher the C_T value, the lower the isolation. C_T values are on the order of 0.2 pF to 4.0 pF.

The maximum rf power (P_A) which the PIN diode switch may handle should be calculated for a case of maximum swr or a totally mismatched antenna. It is done this way because often the transmitter is operated without an antenna or with a shorted antenna connector. For a perfectly matched antenna, the power capability of the diode is increased by a factor of four. The equation used is:

$$P_A = (12.5 \times P_D)/R_S$$

where P_D is the maximum specified dissipation of the device. 12.5 is a constant for 50-Ohm impedance systems. Note from the equation that dissipation is directly proportional to P_D and inversely proportional to R_S.

Combining Series and Shunt Values

Fig. 5 shows a combination of series and shunt connections using two PIN diodes. The circuit shows a diode (D1) series-connected with the transmitter and a diode (D2) shunt-connected at the receiver antenna input. A quarter-wave line is connected between both diodes to help in receiver isolation. During transmit, D1 conducts and transfers rf power from the transmitter to the antenna. Diode D2 is also forward-biased, shorting out the receiver antenna input. The rf current in both diodes is almost equal, even though it may not be apparent. Hence, both D1 and D2 dissipate the same power.

Fig. 6(a) shows another interesting compound switch, the TEE SPST switch. When bias is positive, diodes D1 and D2 are forward-biased, and thus both conduct rf energy from input to output. Diode D3 is reverse-biased. When bias voltage is negative, both D1 and D2 are cut off and diode D3 is conducting, resulting in almost a short to ground. This way, if any rf energy goes through D1 it will be grounded by D3; D2 will improve the attenuation. With this simple arrangement you may construct a switch that will work very well even at microwave frequencies.

Fig. 6(b) shows a practical design using this kind of switch. The importance of this switching circuit is that if you use care in construction, it is easy to achieve more than 50 dB of isolation. Actually, the isolation is much more dependent upon circuit shielding between input and output than limitations imposed by the PIN diodes. This approach is often used in instruments like signal generators and communications monitors.

Designing the Solid-State Rf Relay

To illustrate how all of this information

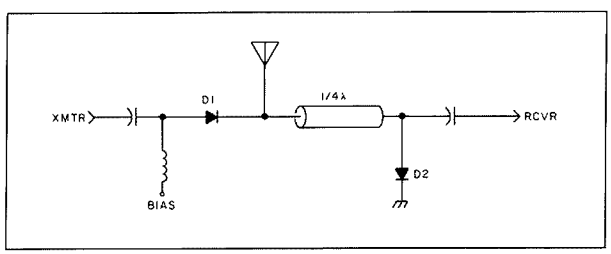


Fig. 5. The series-shunt switch offers excellent isolation.

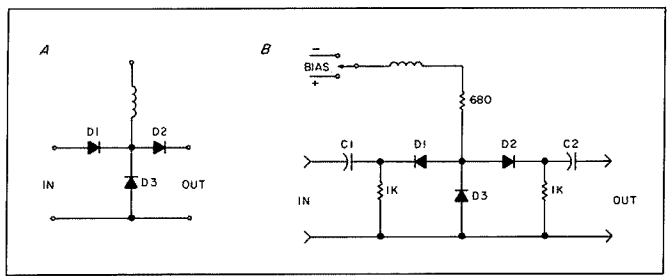


Fig. 6. (a) 50 dB of isolation is possible with the TEE SPST switch. (b) A practical design using the TEE switch.

	ECG553	ECG555	MI301	MPN3401	UM4901	UM4001	UM9401	1N5787	
P_D	0.2	0.4	0.35	0.4	37.5	2.5	1.5	0.4	Watts @25°
$V(B_R)$	30	35	80	35	100	100	50	100	Volts (piv)
C_T	2.0	1.0	3.0	1.0	3.0	3.0	1.1	0.4	pF@100 volts, 1 MHz
R_S	1.2	0.7	2.0	0.7	0.25	0.5	0.4	1.5	Ohms @100 mA, 100 MHz
P_A	2	7	2	7	2 kW	62	47	3.3	Watts @ maximum swr

Note: All specs are for axial-lead packages except the UM4901, which is a stud mount.

Table I. Characteristics of several common PIN diodes.

can be put to practical use, I will design a PIN diode switch to replace the relay in the old VHF FM amateur radio, the Standard Horizon 2.

I began my design by gathering and comparing specifications. Table 1 shows the most important specs of several diodes. P_D stands for the diode's dissipation power. $V(B_R)$ is the maximum permissible voltage allowed by the device. C_T is the capacitance at the specified frequency and applied voltage. R_S is the resistance at the specified current bias and operating frequency. P_A is the maximum amount of power the diode can handle as a switch at maximum swr. From Table 1, I chose the most suitable device for the Horizon 2, using $P_A = (12.5 \times P_D)/R_S$ to determine the maximum power each device could handle.

The Horizon 2 is rated at 25 Watts output; a UM9401 is more than adequate for the job since it is capable of managing some 25 Watts at 50 mA of forward bias at a high swr.

The UM9401 is smaller than a common silicon rectifier diode, but don't judge it on its size! Despite being just 2.29mm in diameter, it can handle more than 100 Watts of rf when properly installed. The UM9415, which is 3.30mm in diameter, can carry more than 1 kW when forward-biased at 1 Ampere and properly installed.

The UM4901 is capable of handling 10 kW of rf CW power or 100 kW of peak pulse power if the antenna is perfectly matched—yet it is not larger than a 10-Watt stud-mounted zener. Several diodes are rated at 1,000 volts or higher.

The most suitable circuit for our application, which is also widely used in modern radios, is the combination of the series and shunt switch, shown in Fig. 5.

First, I replaced the quarter-wave line with an equivalent lumped circuit using components selected from the formulas in Fig. 7. The values computed for the center of the 2-meter band (146 MHz) are 0.0545 uH for L and 21.8 pF for C. Since the circuit capacitance will be part of the circuit, I chose 20 pF for C. The additional capacitance is supplied by the stray wiring capacitances and the C_T capacitance of the diode. The coil is made by winding five turns of enameled #22 wire. Some trial and error may be necessary in this regard, but the recommended values should work in any 2-meter radio.

The bias resistor is calculated using Ohm's Law (see Fig. 7). Assuming a power supply of 12.6 V dc and 50 mA of bias current, the resultant resistance value is 237 Ohms. A resistor of 220 Ohms at 1 Watt is close to the calculated value which, by the way, is not critical at all. For a radio of less power (say 10 Watts) you may use a 270-Ohm @ 1-Watt resistor and the resulting bias current (0.050 A) will be enough. All modern radios use

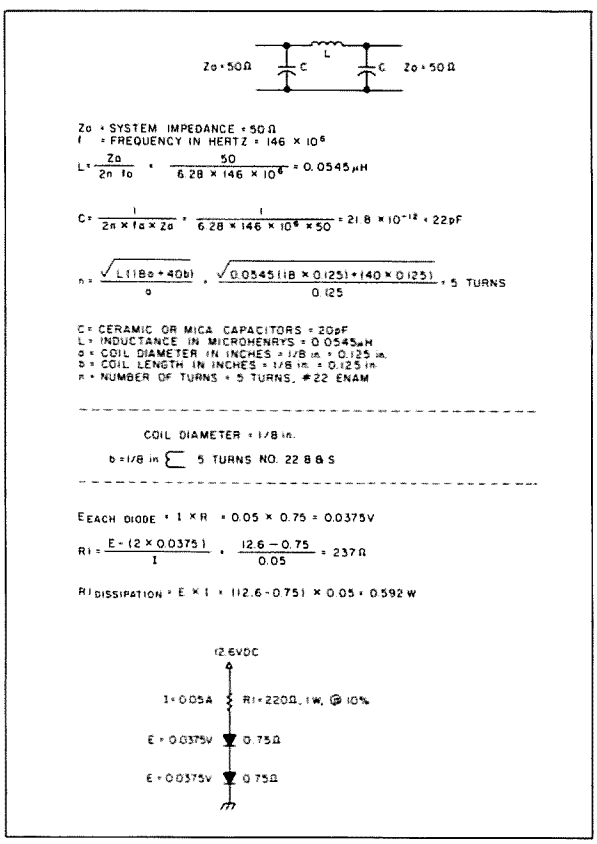


Fig. 7. Formulas used to design a solid-state switching system for the Standard Horizon 2.

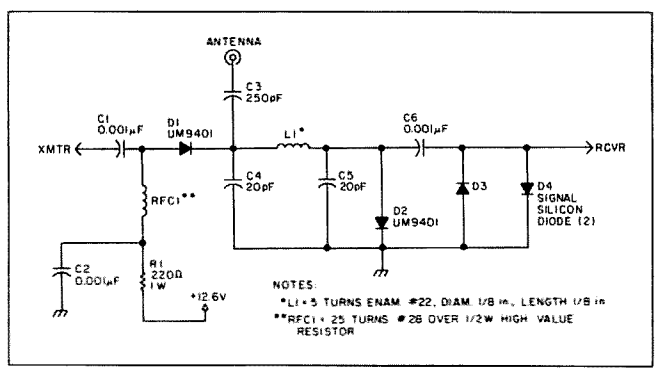


Fig. 8. The Horizon 2's new PIN-diode switch.

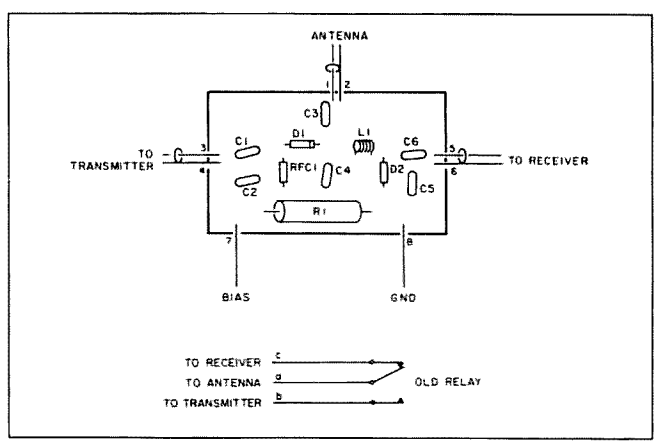
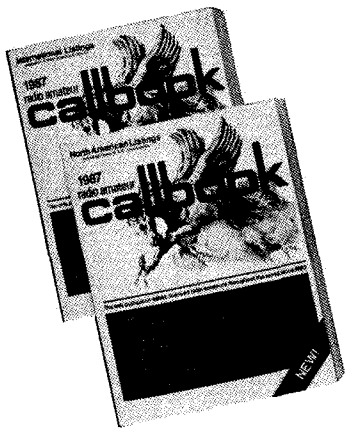


Fig. 9. Parts placement for the PIN-diode switch.

1987 CALLBOOKS



The "Flying Horse" sets the standards

Continuing a 66 year tradition, there are three new Callbooks for 1987.

The North American Callbook lists the calls, names, and address information for licensed amateurs in all countries from Canada to Panama including Greenland, Bermuda, and the Caribbean islands plus Hawaii and the U.S. possessions.

The international Callbook lists the amateurs in countries outside North America. Coverage includes South America, Europe, Africa, Asia, and the Pacific area.

The 1987 Callbook Supplement is a new idea in Callbook updates; it lists the activity in both the North American and International Callbooks. Published June 1, 1987, this Supplement will include all the new licenses, address changes, and call sign changes for the preceding 6 months.

Publication date for the 1987 Callbooks is December 1, 1986. See your dealer or order now directly from the publisher.

☐ North American Callbook	
incl. shipping within USA	$28.00
incl. shipping to foreign countries	30.60
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incl. shipping within USA	$28.00
incl. shipping to foreign countries	30.60
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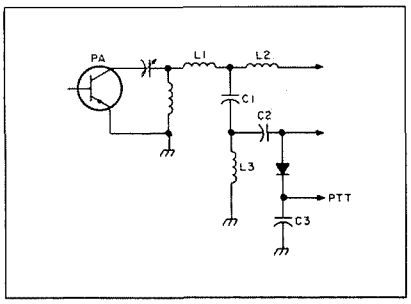


Fig. 10. Motorola used this clever circuit in their Maxar VHF radio.

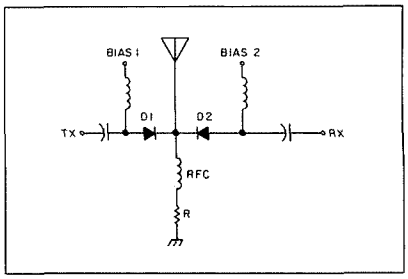


Fig. 11. PIN diodes can be used with good success at HF. . . try this circuit, taken from a Unitrode handbook.

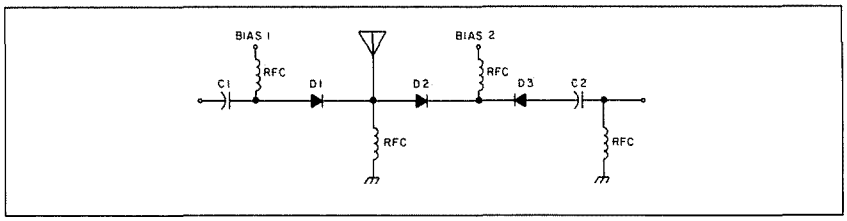


Fig. 12. This circuit will switch up to a kilowatt of rf.

standard 10% resistors installed for this purpose. Should your power be higher (say 35 Watts), use a 150-Ohm at 1-Watt resistor. Remember that the calculation is for an swr of infinity, and if the antenna is perfectly matched the allowable power is quadrupled. This means that, in a transmitter with swr protection, the PIN may be operated with a lower forward bias.

The choke is wound on a high-value half-Watt resistor—put as many turns of enameled #28 wire as you can in one layer. You should shoot for 2.7 uH for VHF or 1.2 uH for UHF.

The completed circuit is shown in Fig. 8. C1 and C6 act as blocking capacitors, while C2 decouples the diode bias line. D1 is the series switch on the transmit side, and D2 is the receiver shunt. C4, L1, and C5 form the quarter-wave section. D3 and D4 provide protection for the receiver input; they clip signals that rise above about 0.6 volts.

Sticking It In

OK, you've got everything built and tested. Where are you going to install your creation? The obvious place is in the space where the relay used to sit. If you end up putting the board in some other spot, try to situate the quarter-wave line and the receiver switch as close as possible to the receiver input circuit. If you can't do that, use coax for the interconnection.

The El-Cheapo Approach

Motorola used a very interesting circuit in their old Maxar VHF radio (Fig. 10). C1, C2, and L3 form a quarter-wave line which is grounded by PIN D1 during transmit—this places C2 at ground potential and C1 at a high impedance. During receive, D1 is cut off and the rf passes through the quarter-wave line. This approach may not work unless your PA is the same as the one shown—note that there is no pi network on the output. I couldn't use this configuration on the Standard since the low-impedance path during receive goes to the wrong place.

PIN Diodes at HF

Even though PIN diodes are essentially microwave devices, they can be used at HF with good success. Unitrode's *PIN Diode Designer's Handbook* suggests using the circuit shown in Fig. 11. This design uses two diodes and two bias voltages. Forward bias is applied to D1 or D2, depending on whether you're transmitting or receiving. The upper frequency is determined by the capacitance of D2, and the bandwidth is a function of the chokes.

Fig. 12 shows another approach to HF switching, again by Unitrode. Using the diodes shown, the circuit will safely handle up to a kilowatt of rf. D1 should be selected for its power dissipation, and D2 for its capacitance (D2 doesn't handle much rf current so you can pick a less expensive device with a lower dissipation). Again, the bandwidth is a function of the chokes.

Finally, the 1985 ARRL *Handbook* describes an outboard design based on Unitrode's UM5767. The circuit, a variation of the one shown in Fig. 8, handles 100 Watts. Transmitted rf is coupled to the antenna through a lumped quarter-wave circuit; the diodes are installed only in the receive path (which means that they need not handle much rf). This could be the perfect compromise for your old SSB transceiver, and might even be cheaper than replacing a relay.

In Closing

The modification I've described for a VHF radio is very simple, and you should have no trouble adapting it to just about any unit. If you get really stuck, send me an SAE, a handful of IRCs, and a complete description of the radio you're trying to modify. ■

William F. Hoisington K1CLL
Wilder Road
W. Peterborough NH 03458

Shoestring Shortwave

Turn a handful of parts and a piece of wood into a two-transistor shortwave converter.

Number 3 on your Feedback card

Here is a basic shortwave converter that uses only two low-cost transistors and two D cells for power, and is designed for low overall cost with no sacrifice of sensitivity or selectivity. The circuit converts frequencies from 6 to 21 MHz to the AM broadcast band. No wires or connections of any kind to the AM set are needed—a ferrite-core coil positioned near the loopstick of the AM set will do the trick. The AM set supplies the sensitivity, selectivity, avc, audio, and loudspeaker for good reception of shortwave stations from around the world.

The converter is wired point-to-point and thus is easily maintained, repaired, and modified. It's simple to just add on sections for different modes, such as CW, SSB, FM; for microwaves; and for special frequencies as desired. Modules plug together with phono jacks, so the radio can be reconfigured in a matter of minutes.

Front panels are of double copperclad phenolic—my long-time favorite because the thin copper solders with the touch of a small iron, and the phenolic is very strong for front panels, boxes, shield walls, sub-panels, etc. The main base is wood; each module is fastened down with one large screw for easy servicing, modifications, add-ons, and other changes you might want to make later (see Fig. 1).

Construction

The first module is the preselector, shown in Fig. 2. L1 is wound on a high-Q ferrite core, which cuts down image response and increases selectivity. The circuit is tuned to the desired frequency by C1, a 365-pF maximum capacitor. No vernier is needed, as the tuning is not that critical. The shielded output cable to the mixer module is coupled to L1 via L2 (two turns of wire around the ground end of L1).

Oscillator Circuit

The oscillator module requires more care in its construction, testing, and tuneup, but expect no trouble if you follow instructions carefully. Look at Fig. 3. L10 and C10 determine the frequency in the 6–21-MHz range. The emitter of Q1 is tapped up one turn from the ground end of L10 through C12, which produces feedback to Q1 and causes oscillation. (When measuring voltage in this circuit, always take care to differentiate between the dc and the rf voltages. The collector has the full 3 volts on it from the battery supply, as well as the maximum rf voltage. The base has 1.2 volts dc on it when operating but is grounded for rf by C11; thus it has no rf voltage on it, measured to ground. The emitter has 1 volt dc on it, measured to ground, and also a small amount of rf.)

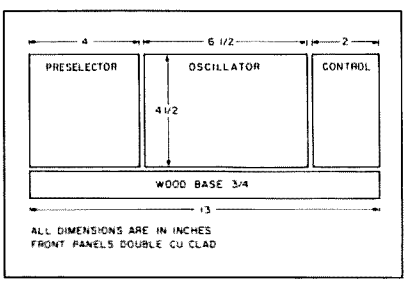


Fig. 1. Front view of the converter. Modules are mounted on a piece of 3/4" wood.

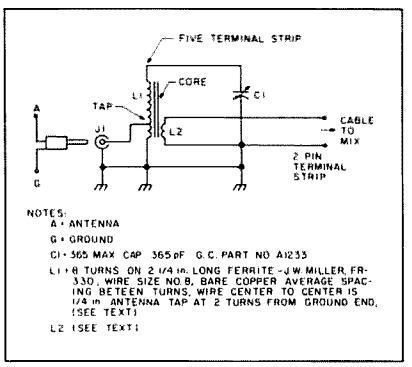


Fig. 2. Preselector schematic.

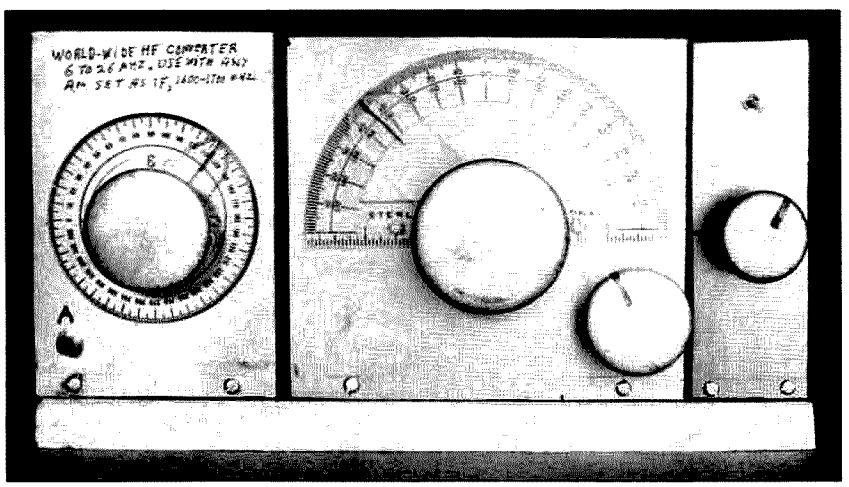


Photo A. A spruced-up front panel for the prototype converter on the cover of the magazine. Two protractors are installed for ease of logging.

The rf generated by Q1 through its feedback circuit and present on L10 is coupled to L11, a single loop, and sent via the oscillator cable (which may be twisted-pair or shielded cable—not critical) to J21 of the mixer module. The position of the emitter tap on L10 controls the amount of oscillation, and may be adjusted as follows—this *is* critical. Move the tap a little closer to ground (perhaps three-quarters of a turn from ground) to *reduce* oscillation and perhaps one and one-quarter turns *away* from ground to increase oscillation. Too much feedback will show up as a lot of loud noise when the set is operating.

L11 does not need to be over L10. Best results are had by placing L11 over the ferrite core only, spaced about one-eighth to one-quarter inch from the low-voltage end of L10. (This is the end of L10 that is bypassed to ground by C14 and also is the +3-volt connection.)

In order to place the low-frequency end of the range (6 MHz) near but not at the end of the dial, add or subtract slightly from the high end of L10. This is where the collector and C10 are connected. You will find few BC stations lower than 6 MHz.

Mixer Circuit

The circuit in Fig. 4 has been designed to offer good sensitivity, low noise, and considerable gain. The base of Q2 receives the tuned rf signal from the preselector through C22. The emitter receives the rf oscillator voltage through C21. The dc voltage on the mixer base is +.6 to +.8 volts, and on the emitter it is +.4 volts. The collector has the full battery supply of 3 volts on it. There are no tuned circuits in the mixer module itself, but the collector output is tuned in the control module by C31 and the mixer output coil, L40, which couples the mixer to the AM set.

A small copperclad wall is used to shield the input circuit of the mixer from the output. This is not critical as the frequencies are different, being separated by 1,600 kHz.

Control Module

The output from the mixer goes over a low-capacity cable to the control module where C31 tunes the mixer collector output, the cable, and the AM pickup coil to the frequency to which the AM set is tuned (see Fig. 5). The control module also contains the on/off switch for the 3-volt battery supply to the oscillator and mixer transistors, Q1 and Q2. The AM output coil, L40 (see Fig. 6), is tuned by C31 to an i-f of around 1,600 kHz. There generally is a more or less quiet spot to be found there, although occasionally between 1,800 and 1,600 kHz you may hear a neighbor telephoning a friend! The mixer output is very strong, however, and will swamp out all but a very loud local signal. If you run into trouble, just bump the i-f a little.

Note that there are a number of items in this chain, each contributing to the total capacitance, so do not be surprised at the relatively small number of turns (low inductance) in output coil L40. It works!

L40 is what you use to control sensitivity and selectivity. If you're trying to pick up

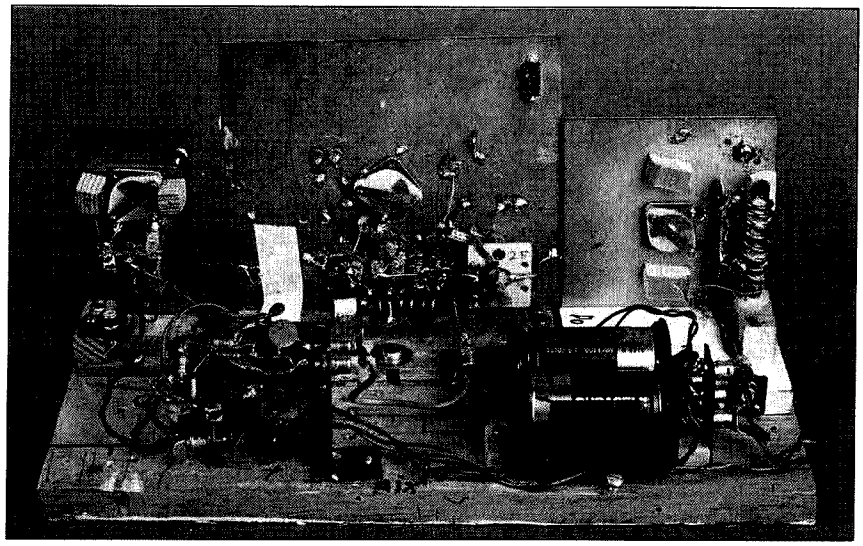


Photo B. Interior view of the prototype.

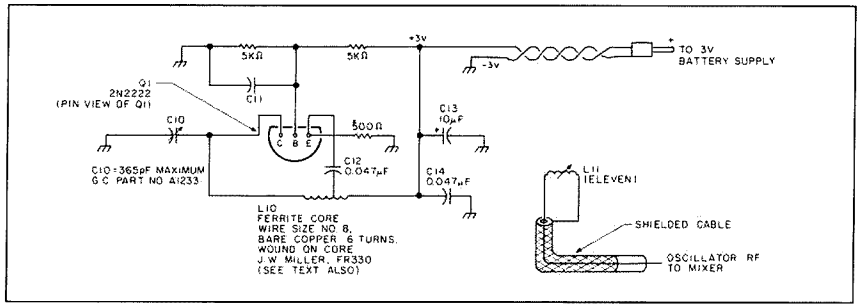


Fig. 3. Oscillator schematic.

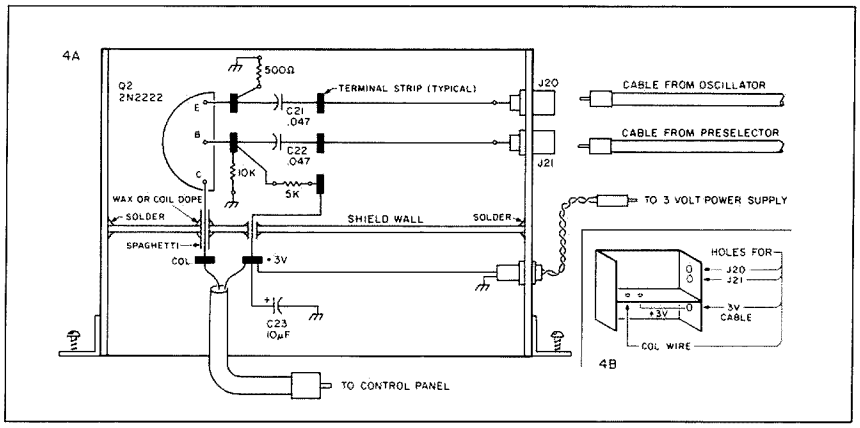


Fig. 4. (a) Pictorial schematic of mixer; (b)mixer shield box.

KITS AVAILABLE

The shortwave converter described in this article is available as both a kit and an assembled unit. The version for sale looks a bit fancier than the one pictured on the cover (we wanted to get your attention). Send $49 for the kit or $69 for the assembled version (postpaid) to Conelec Corp., Box 538, Peterborough NH 03458, Attn: Kit Sales.

Three add-ons will be available for the shortwave converter not too long from now; they have been designed and tested and work well. They do not require any internal changes in the converter described here. They are: a bfo for reception of CW and SSB; a low-noise rf stage for improved reception and better image rejection; and a simple detector for the 5–21-MHz range that lets you check the frequency of your oscillator.

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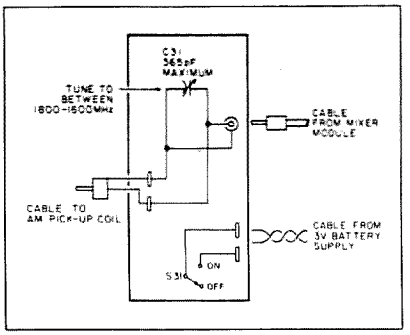


Fig. 5. Back view of the control module.

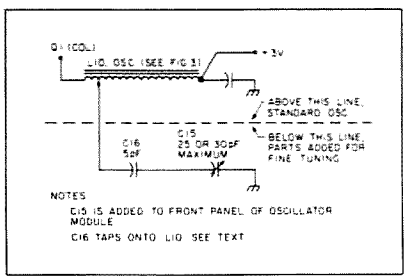


Fig. 7. Optional fine-tuning system.

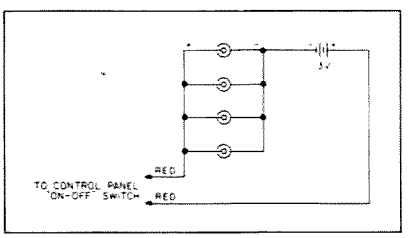


Fig. 9. Power supply schematic.

a weak station, bring L40 close to the AM set. Moving L40 away from the AM set will decrease the coupling, and give you more selectivity.

The AM Set

Nearly any AM set that has a built-in loopstick coil for its antenna will work with the shortwave converter. I have yet to see one that is in at least fair condition that does not work well as the i-f and af portion of the overall receiver. Even a ten-dollar pocket portable will do, although you probably won't like the music quality (I don't!). The AM set furnishes good sensitivity as an i-f as well as good selectivity, good agc, and, if the AM set is of good quality, fair fidelity.

Operation

The first thing to do is set up the AM radio. Turn on the AM set and tune it to a quiet spot between 1,600 and 1,700 kHz. Place the output coil of the converter (L40) near the AM set. Now switch on the converter and twiddle C31 until you hear noise in the AM radio. You shouldn't have to adjust this again.

Attach an antenna—the length could be 10

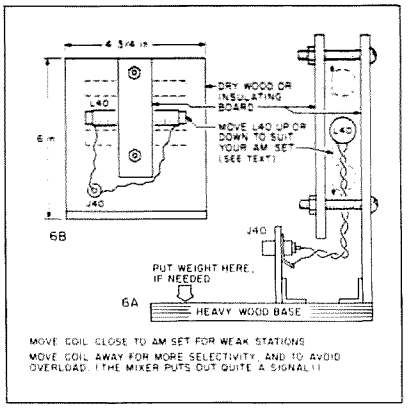


Fig. 6. (a) AM set pickup coil; (b) back view.

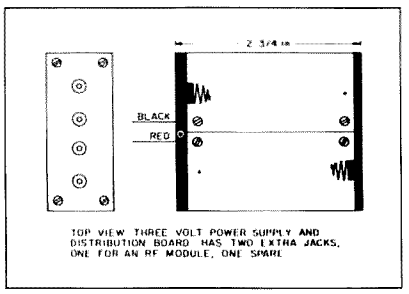


Fig. 8. Top view, 3-volt power supply and distribution board.

or 15 feet indoors, but 50 feet outdoors is better; 100 feet is fantastic! Stretch out the wire on the floor, tape or tack it near the ceiling, or tie a string to it and throw it outside over a bush or tree. Good shortwave antenna kits are also available, of course.

Tune C10 slowly, especially at the high end of the frequency range, to find the station you're looking for. If you are a bit heavy-handed, you might want to try the optional fine-tuning system shown in Fig. 7—use a giant knob to increase the bandspread even more. If you use this optional circuit, move the tap connecting C16 to L10 in order to adjust the amount of fine-tuning you want. I found that two turns from the high end of L10 suited my needs. Keep the wire of C16 no more than half an inch in length. Set C15 in the middle of its range and tune C10 to the general area you want. C15 will then tune over several stations on each side.

A good way to keep track of your activities is to use stick-on labels. When you hear a station, just fasten a sticker right to the dial. You can also use an inexpensive protractor as a logging dial—fasten it directly on the face of the converter.

One of the important features of this converter is its availability for instant use in case of emergency—so it is dry-cell battery powered. The two transistors, Q1 and Q2, use very little current: 3.5 mA total. The system is therefore quite economical. Use two heavy-duty D cells for maximum stability. At least one good portable AM set should be on hand for this emergency use. ■

THE END OF THE ROPE

Guy Slaughter K9AZG
753 W. Elizabeth Drive
Crown Point IN 46307



Number 4 on your Feedback card

I have just given up a skill it took me years to perfect, swearing never again to help a fellow ham hang an antenna among his trees. It isn't that I don't like to be a nice guy. It's just that I can't afford being sued. Besides, my wife says she'll set fire to my shack if she catches me playing the Good Samaritan of the Skywires again.

See, I got myself in trouble the last time I did my thing, thus proving that nothing is foolproof, not even my Indiana Rope Trick.

You've probably heard of the Indian Rope Trick, where a fakir in a turban flutes a snake out of a basket, turns it into a rope, and levitates it up into the air so his stooge can climb it. Big deal. The act winds up with this rope standing there, an Indian kid atop it, of no use to anyone.

My version is infinitely superior. I levitate a rope into the top of a tall tree without a snaker or a faker, nobody has to climb it, and it supports an antenna wire up there above the housetops where it can radiate as much rf as you want to feed it.

I don't use magic, as the Indian practitioners claim to do, or mass hypnosis, as their detractors contend they actually do. My system is earthy, pragmatic, and simple, and is based solely on skill and marksmanship. I had been practicing it for years without a problem, until just a couple of months ago.

That's when the doorbell rang at my house, repeatedly, insistently, as I ran up the stairs from my basement shack to answer it. I found an agitated young man on my front stoop, jumping up and down in apparent excitement. He was wearing a T-shirt, jeans, a baseball cap, and sneakers.

"I was driving by," he said breathlessly when I opened the door. He jerked his thumb at an angle upwards, toward the trees in my backyard. "You the guy owns that antenna?"

"Yes," I said, craning my neck to see if the wire had come down. "What's wrong with it?"

"Nothin's wrong with it. That sucker's up 50, 60 feet, hangin' in them trees!"

"Closer to 70," I said, wondering if I was supposed to have a city permit for so high a wire, or maybe a red flasher light to warn airplanes away. "It's been up there more'n a year."

"But them're locust trees. Nobody can climb to the tips of locust trees."

"I know."

"You got a lot of wire up there."

"About 270 feet," I said. "It's a full-wave loop on 80 meters. So?"

"So how'd you get it up there?"

"Ropes," I said. "Four of 'em. One in each corner. It ain't quite a perfect diamond on account of the uneven tree spacing. And it ain't quite horizontal either, because the trees are different heights. But it's close. What's your name?"

"Charley," the young man said. "I know, ropes. Of course, ropes. But how'd you get them ropes up over them treetops?"

"Oh," I said, understanding. "Shot 'em up there. My name's Guy. You a ham, Charley?"

"Yeah," he said, looking disappointed. "A ham with tall trees like you got there that nobody can climb. But I've tried that shootin' system, and it don't work. The branches're too thick. The arrows get caught in 'em."

"Can't use arrows in locusts," I said. "Nor in other snaggle-branched trees, either." I stepped back out of the doorway. "Come on in. How about some coffee?"

"If not a bow and arrow, whadya use?" Charley demanded, stepping inside, "a harpoon gun?"

"A slingshot," I said, leading him into the kitchen and waving him onto a chair. "One of those commercial slingshots powered by surgical-rubber tubing on a steel fork. Cream and sugar?"

"Black," he said, watching me pour coffee into a couple of cups. "I don't think a slingshot'll work at my place. My trees're awful thick and snaggy."

"It'll work," I told him. "Guaranteed. It's all in the projectiles. I use old spark plugs. They're ideal. Good and heavy, easy to tie to, perfect shape to penetrate tree limbs and fall back through snaggy branches."

"You tie a string to the plug, then use the string to haul a rope up?"

"Not string. I use a spinning rod with an open-faced reel carrying about a 10-pound test monofilament. That weight's light enough to shoot and strong enough to pull a polypropylene cord up with. The cord then can haul a rope up. Be happy to demonstrate it for you."

"At my house?" Charley asked, apparently enthralled at the prospect.

"Where else?" I said.

"For how much?"

"For free. I only do the Indiana Rope Trick as an amateur. Drink up and I'll show you my shack."

That was on a Wednesday. I was a little bit late arriving at his place the following Saturday morning because I got lost trying to find it. He was waiting in the front yard by the curb, pacing back and forth when I drove up. He looked relieved. Beyond his house I could see a half dozen tall trees extending well above the roof line and waving in the wind.

"I thought maybe you weren't coming," he said as I climbed out of the car. "Too windy or something."

"Took a wrong turn," I said, handing him the spinning rod. "Little wind won't bother. Hang onto that for me."

He took the rod, and I followed him around the house, through a gate and into his chain-link fenced backyard. "So where do you want the skyhook ropes?"

Charley pointed to two trees in opposite corners of the yard. There was a dipole strung between them, low, maybe 25 feet off the ground.

"There and there. I want to hang a delta loop cut for 40 between those two locusts. I'll feed it from the apex at the bottom."

"So you need to tie off the top corners at

least 50 feet up," I said, eyeing the target trees. One was close to 70 feet tall, the other maybe 10 feet shorter.

"Can do?" Charley asked.

"Can do," I said. "May take a few tries, but can do."

A little crowd had gathered to watch us. There were three kids, a dog, and a mean-looking woman I took to be Charley's wife standing in the yard. He didn't introduce us.

"Watch closely," I told the audience, tying a loop in the end of the monofilament spinning line and encircling the spark plug above the threads between the gasket washer and the porcelain. "Nothing up my sleeves." I leaned the rod against the fence, unlatched the reel, centered the spark plug in the leather pouch of the slingshot, aimed just above the top of the taller tree, and fired. The projectile arched through space, trailing its almost invisible tether line, started earthward well beyond the treetop, dropping the monofilament into the highest branches. I laid down the slingshot, picked up the spinning rod, and latched the reel.

"First shot looks good," I said. "You want to go find the spark plug, unfasten it, and tie your pilot cord to the fishing line? Then I'll start reeling it in."

"Right," Charley yelled. He galloped off, disappeared behind the target tree. I began reeling gently, feeling the line slip through the branches, stopped when the weight of the spark plug tugged at the rod tip.

Suddenly there came a caterwaul from behind the target tree—shrill, loud, ear-piercing screams of a human being in physical agony.

I dropped the rod and took off for the noise on the dead run, vaguely aware that I was being followed.

I found Charley trying to shake off a squirrel that appeared to be firmly attached to his hand.

"Ayyyyyy, get it off," he was screaming, swinging his encumbered hand back and forth at arm's length and bludgeoning at it with the other hand. "Ayyyyyy, get it off!"

I made a stab at the squirrel as it swung past me on the end of Charley's arm like the knob on the end of a pendulum, missed, tried again as it swung by on the return cycle, hit warm and yielding fur, saw the animal drop off and streak away across the grass.

My recollection of the next few seconds is blurred and comes in bursts—frozen-action scenes from a slow-motion movie, a series of time-lapse, strobe-stopped snapshots with sound. Charley, his hand spouting little geysers of blood from a dozen perforations, was prancing about under the tree, continuing to scream, waving his arm back and forth as if flagging down a train. The mean-looking woman I took to be his wife came pounding up behind me, began to beat me about the head with her fists, and joined in the screaming. The squirrel scampered up the tree trunk and disappeared into the lower branches. The spark plug I had but lately fired into space hung waist high off the ground, swinging slowly from an invisible tether.

I left it swinging and departed, hurriedly, not stopping for either my spinning rod or my slingshot, the screaming still ringing in my ears, the blows still falling about my head until I managed to outrun the mean-looking woman, maybe halfway to my car.

The blurred details of the incident later were clarified somewhat by a summons inviting me to appear in court as defendant in a civil suit seeking $5,000 for medical expenses, for pain and suffering and for loss of income sustained by the plaintiff while recuperating from multiple squirrel bites.

The bites, the complaint said, were suffered by the party of the first part when he picked up from the ground and comforted an unconscious squirrel that had fallen from a tree. The animal panicked when it recovered consciousness to find itself a captive, the complaint theorized, and ran toothily amok to bite repeatedly the hand that fondled it.

"Ayyyyyy, get it off," he was screaming, swinging his encumbered hand back and forth at arm's length and bludgeoning at it with the other hand. "Ayyyyyy, get it off!"

The hapless beast was blameless, the complaint further alleged, an innocent third party that had been minding its own business in its own nest atop a tree owned and controlled by the party of the first part, the plaintiff-victim, when the defendant-villain, party of the second part, precipitated the unfortunate incident by shooting the defenseless creature out of its home with a steel and porcelain projectile fired from a hunting-type slingshot, causing it to fall to the ground below. It was the impact of the projectile against the squirrel that produced its stunned and unconscious condition, the arousal from which led to the plaintiff-victim's injuries, the complaint said, which were the final link in a chain of circumstances clearly forged by the defendant-villain, me.

The outcome could have been worse.

My lawyer settled the case out of court, happily forestalling a possible criminal prosecution for unlawful squirrel hunting in a protected area, out of season and without a license. My insurance agent grudgingly paid part of the medical costs. And my wife granted me reluctant permission to buy another spinning rod—if and when I can afford one—after ordering me, on pain of setting fire to my shack, never ever to practice again my Indiana Rope Trick.

I promised not to, of course, considering this to be a great, though necessary, sacrifice. It is, after all, the one thing I do really well.

But would you believe I already have had that promise put to the test?

Yesterday the doorbell rang at my house, repeatedly, insistently, as I ran up the steps from my basement shack to answer it. I found an agitated young man on my front stoop, jumping up and down in apparent excitement.

"Those are locust trees," he said breathlessly, jerking his thumb at an angle upwards towards the antenna in my backyard. "You got an antenna hangin' from 'em up there 50, 60, maybe 70 feet high. How'd you do that?"

"It was easy," I told him. "I put ropes in their tops when they were saplings. Then I waited for them to grow."

He stared at me in silence for a long time. Then he left, and sadly I watched him go. ■



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A Simple Way to Measure SSB PEP

Just stick out your tongue and say "ahhhhhhh."

Number 5 on your Feedback card

In the "good old days," compliance with the FCC's power regulations required nothing more than measuring dc power input to the final stage under steady-state conditions. All you had to do was multiply plate voltage times plate current on the final tube(s) or transistor(s). A kilowatt was a kilowatt: 2000 volts times 500 mA = 1000 Watts. That's a kilowatt, and that was the legal limit.

Then, single-sideband suppressed carrier came along and knocked ordinary power-measurement practices into a cocked hat. How do you measure dc power input with a plate ammeter that jumps all over? Even the ARRL didn't know—and apparently still doesn't. Nonetheless, there was and is a way. And it doesn't require the use of a calibrated oscilloscope, LEDs, so-called PEP wattmeters, or magic. Mind you, we now have to be concerned only with *output* power, not dc input power.

The FCC has defined peak envelope power (output) as "the average power during one radio frequency cycle at the crest of the modulation envelope, taken under normal operating conditions." I'm not really sure why the FCC included the word "average" in the definition when speaking of peak, or crest, but I think I know what they mean: the *maximum* power coming out of the transmitter or final amplifier.

Let's look at the simplest example, a maximum legal limit CW (A1) grounded-grid linear amplifier. We will use existing equipment found in most ham shacks. The FCC says we are limited to 1500 Watts PEP (output). All we have to do is tweak, peak, and load until the in-line wattmeter shows 1500 Watts of rf. That is 1500 Watts PEP (output) and presently the maximum we are allowed. Wasn't that simple? We didn't have to make plate-voltage times plate-current calculations, and we didn't have to apply any "fudge factors" to the wattmeter indication. We didn't even have to include the rf drive power from the exciter.

It isn't quite as simple to calculate the A3J (SSB) PEP output measurement, but it's not very hard to do, and you can do it with the same average-reading wattmeter that you already have—the Heath HM-102, Drake W-4, or the like. But we will have to take into consideration certain dc-power input parameters, plate voltage, and plate current.

The example given here presumes that the final amplifier has been properly loaded into a nonreactive load, be it dummy load or antenna, or through an antenna coupler (transmatch, matchbox, L-network, etc.). The use of a suitable monitor scope, such as the Heath SB-610, SB-614, or the like, is indispensible for proper loading of a kW amplifier. See "Tweaking Your Linear," *73*, October, 1978.

Let's say that our amplifier is the venerable Heath SB-220 (two 3-500Zs), and we have adequate drive power to run it up to about 1500 Watts output on CW. That will take an exciter capable of from 135 to 150 Watts output on CW. After tweaking, peaking, and loading—really trying hard!—the wattmeter shows only 1200 Watts. At the same time, the plate-voltage meter indicates 2500 volts and the plate ammeter shows 800 mA. This is typical. Amplifier efficiency seems to be 60% (1200 Watts out divided by 2000 Watts in = 60%) in a fully loaded condition, and that is reasonable.

Would you believe that these conditions also will produce the 1500 Watts PEP (output) that we are looking for? They will, and I will tell you why.

Under the full load of 800 mA, plate voltage was 2500. With no load plate, voltage was about 3000—not perfect regulation but what you'll find in most cases. Switch the exciter to SSB operation and set the mike gain to show desired ALC indication while saying "ahhhhhhh" into the mike.

Take a deep breath and say "ahhhhhhh" again, but this time notice and record the plate-voltage indication. Is it 2800 volts? Let's say that it is. The current drain on the power supply has pulled the plate voltage down from 3000 to 2800, and the lighter duty cycle of your "ahhhhhhh" (compared with the constant duty cycle of your carrier) has

THE RIGHT WAY TO GET EXCITED

Correct adjustment of the exciter is very important. It seems that many ops are confused by the "Mic/CW" or "Carrier Level" controls on their rigs. They are under the misapprehension that the CW-level pot also controls the output level of an SSB signal. On *some* solid-state rigs, it will; on most, it won't. Usually, therefore, during SSB operation, the CW or carrier-level control is inoperative and has absolutely no effect on SSB output power.

Whether or not it does can easily be established (without even reading the manual). Tune up the rig as usual. Note CW/Tune output power with the CW carrier-level control full up, fully clockwise. Let's say it is 100 Watts. Without changing any adjustments, switch to SSB operation and whistle into the mike a clear, steady tone. Sustain the whistle and adjust the CW carrier-level control. If there is no change in output power, the control is inoperative on SSB.

If the carrier-level function is controlled by the same knob as used for microphone level, use the whistle test and note output power at the point where the ALC meter or indicator begins to show ALC activity. The power level indicated on the wattmeter is approximately the actual output power of the exciter under SSB conditions.

allowed it to be somewhat higher than 2500—12% higher. *This is the key factor in determining PEP under voice conditions!*

Ohm's Law (I = E/R) prevails. An increase in E (voltage) produces a corresponding increase in I (current) when R (resistance) is constant. If the high voltage increases by 12%, then plate current increases by 12%. So: 2800 x (.800 x 1.12) = 2800 x .896 = 2508.8 Watts input. We have already determined that the loaded efficiency of the amplifier is 60%, and all we have to do to find the PEP output power of our SSB modulated signal is multiply plate-input power times the efficiency factor:

2508.8	plate-input power (dc)
x .60	efficiency factor
1505.28	PEP output (rf)

regardless of what the average-reading wattmeter says! I repeat: Regardless of what the average-reading wattmeter says! With an "ahhhhhhh," the HM-102 or W-4 might indicate only 200 Watts. If it shows much more, like 400 Watts, your processor is driving the pants off the final and you're probably splattering unnecessarily. (Is there ever "necessary" splatter?) Keep the processor turned off for the test.

Oh, you're wondering what to do about the illegal 5.28 Watts? Forget it. It's only .352 percent illegal. Or, if you're conscientious, unload the *exciter* by .352 percent. The amplifier is linear, isn't it?

Good luck! ■

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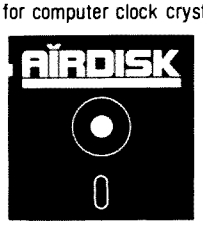
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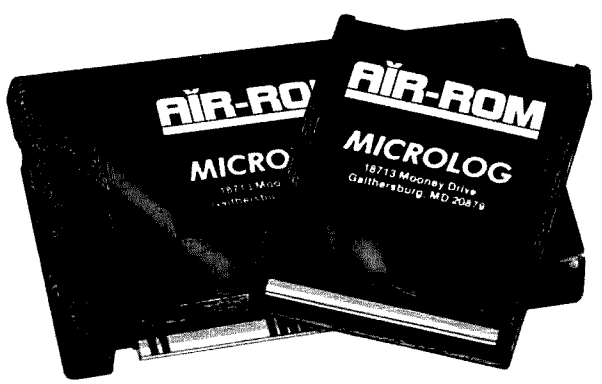
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■ Put some fun in your Flescher
■ Get your CP-1 in the chips
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Microwave Building Blocks: The I-f Amplifier

Practical, versatile, and inexpensive— here's the heart of your next receiver project.

Number 6 on your Feedback card

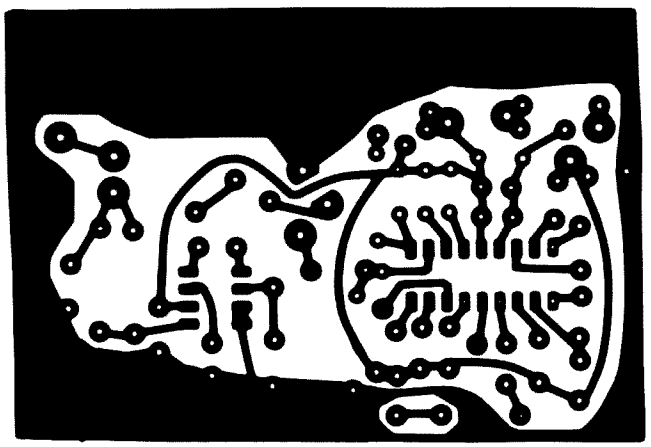


Fig. 1. Printed-circuit pattern, foil side.

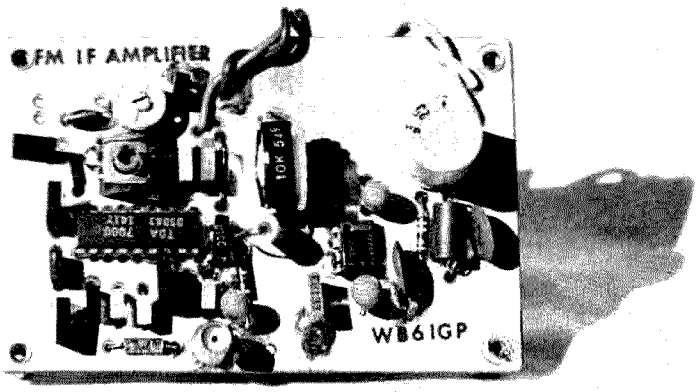


Photo A. The finished i-f amplifier. You can set the gain from 20 to 200 by simply swapping a few parts.

This versatile i-f amplifier is so easy to build and use it will amaze you. The heart of this project is the Signetics FM radio integrated circuit. Few external components are required to construct this very good quality, low-cost ($3 for the chip, in single quantities) FM radio or, in my application, an i-f strip. This is the first one-chip radio that I've made and the performance has astonished me. I've opened up many of the small imported radios and thought of converting them for monitor use on different frequencies, but the modifications proved to be futile, took too much effort, and expended a lot of time.

What I was looking for was an FM amplifier strip that was small enough to be mounted inside several different kinds of test equipment or other communication devices such as Gunnplexers, spectrum analyzers being used as system monitors, and 30- and 70-MHz test-bench i-f amplifiers. The primary use I have in mind is an FM i-f amplifier for use with a 10-GHz transceiver that I am building. The plan is to set the amplifier up on 30 MHz and enclose it within the transceiver's case—instead of using an old FM car radio. Besides, the current drain reduction and the size and weight make this package very attractive for portable work.

The good old FM car radio worked well as long as you stayed close to its original frequency range. Pulling them down to 70 MHz worked OK, but having a stereo receiver tied to the side of my microwave receiver just looked a little tacky, and it was bulky. Something smaller was required, and this chip from Signetics proved more than satisfactory.

PC Design

After I obtained the parts, I started to lay out a test circuit. It worked so well that I constructed a printed circuit board—I realized that I would be building several of these circuits for receivers and other pieces of test equipment. There are many applications for this i-f amplifier due to the ease with which

it can be moved from one frequency to another. The maximum frequency that the chip will perform at is about 115 MHz. Sensitivity is 3 microvolts for a detectable signal with slight noise, and about 5 microvolts for full quieting.

The Chip

The chip requires 5 volts and draws about 8 mA. The only function that needs alignment is the resonant circuit for the oscillator (a parallel coil and capacitor). All other functions are taken care of on board the chip. The internal i-f amplifier runs at 70 kHz and is a frequency-locked loop. Sensitivity is obtained by the use of active RC filters. I was very surprised to find that Signetics had packed so many functions onto one relatively small chip! They include an rf input stage, mixer, local oscillator, i-f amplifier/limiter, phase demodulator, and a mute detector.

Construction

I started the printed-circuit layout with two-to-one templates using the circuit suggested by Signetics. These templates have almost all of the commonly used components at double their normal size. This drawing aid makes laying out a printed circuit board very easy: I can shift components around with my eraser until I obtain the final design. The templates come in standard size (1:1) and double size (2:1) and are called PC Designer PC-1 (1:1) and PC-2 (2:1). They are made by the Tangent Template Company and are available through many of the electronic parts suppliers that advertise in *73*. (See Fig. 1 for the PC-board artwork).

I added a small low-power audio amplifier to the i-f amplifier so that the total current drain would be minimal. I chose the LM-386 because of its low battery drain and high gain. Again, the audio chip was designed to hold the number of external components to a minimum. This audio chip will complement the amplifier quite nicely. The audio level will not drive you out of the living room, but with 400 mW the audio level should be about right for most applications.

I could have used fewer components on the audio amplifier, but wishing to lay the board out only one time, I provided for all bypass and gain options (Photo A). This only adds three components to the basic design but I feel it's worth it. If you need to modify this circuit for other applications, the layout is there. The capacitor on pin 7 (10 uF) is used on higher-gain operation; the resistor and capacitor combination between pins 1 and 8 establishes the higher gain ratio. By leaving the pins open, the amplifier will provide a fixed gain of about 20. By adding these extra components, gain can be increased to 200. I have set the gain to 50 with the 1.27k resistor and the 10-uF capacitor.

Preparation

I prepared the printed circuit board (Fig. 1) by taking a small drill (about 30 mils) and drilling out all holes except those that require grounding. (A good place to obtain very small bits is a model train store that specializes in construction of HO-gauge models.) Then take a larger drill, say 3/16 or so, and on the ground side of the board ream out the copper away from each hole. When the components and ICs are installed they will not touch any ground foil on top of the PC board. After the holes have been reamed out, drill the remaining ground holes and do *not* ream them. Component leads passing through the unreamed holes will be soldered to both sides of the printed circuit board, making for a very short ground.

The circuit might look a little unusual with most of the capacitors referenced to the dc bus; this is proper with this circuit. See the parts placement diagram (Fig. 2) and the system schematic (Fig. 3). Trying to refrain from using jumpers and very thin lines on the PC board, I had quite a time trying to figure out how to run a ground lead through the dc bus. I forgot about the upper ground surface—it was a natural. Grounding pin 3 of the i-f amp to the upper ground foil provided a very good shield and the shortest possible ground leads. When circuits are operating at frequencies such as this, the very short grounds are very desirable from a stability standpoint.

Local Oscillator

The local-oscillator coil circuit is the only part of the design that needed some tinkering with to make it work. I used a 1/8"-diameter coil form wound with 5 turns of #26 wire. With a 37-pF capacitor in parallel I was able to grid dip the circuit at about 50 MHz. The coil form had a shield, and when I placed the shield over the coil and soldered the case to

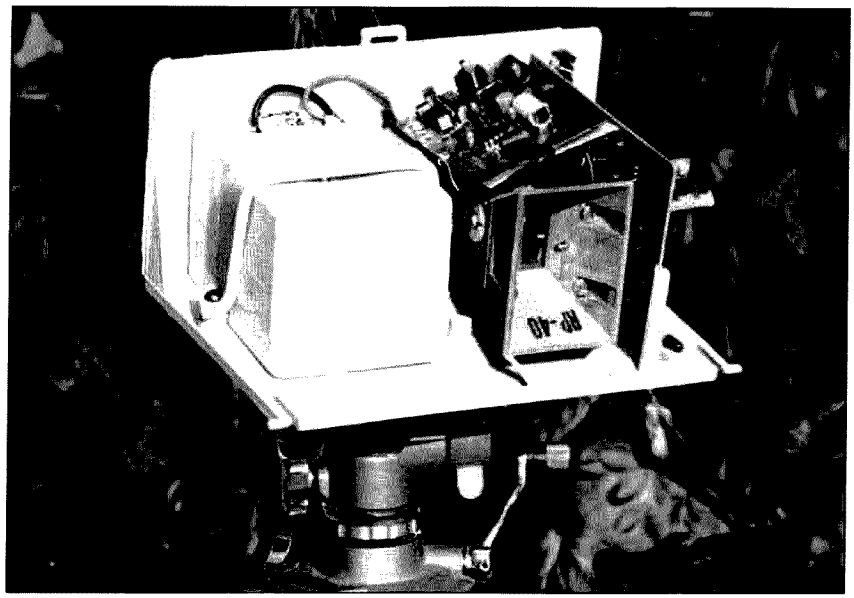


Photo B. The 10.250-GHz intrusion alarm used for a QSO with N6IZW. The i-f amp is on top of the stack.

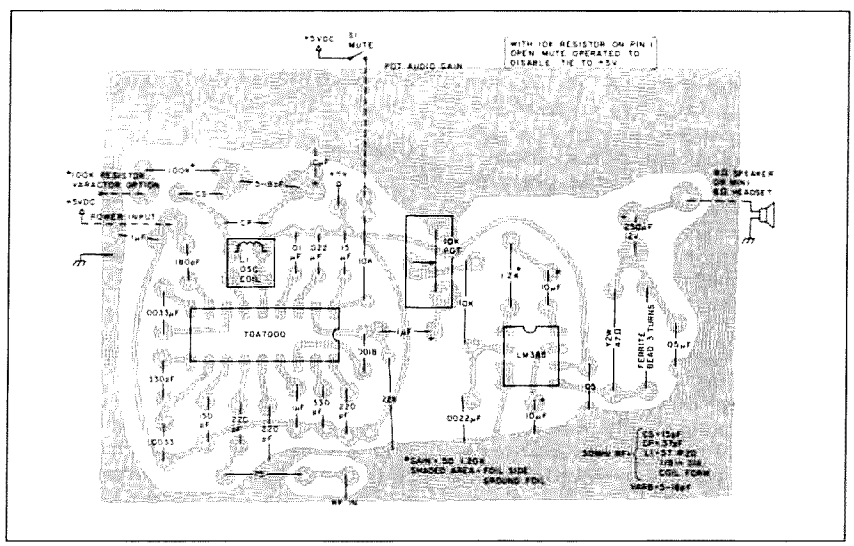


Fig. 2. Parts placement.

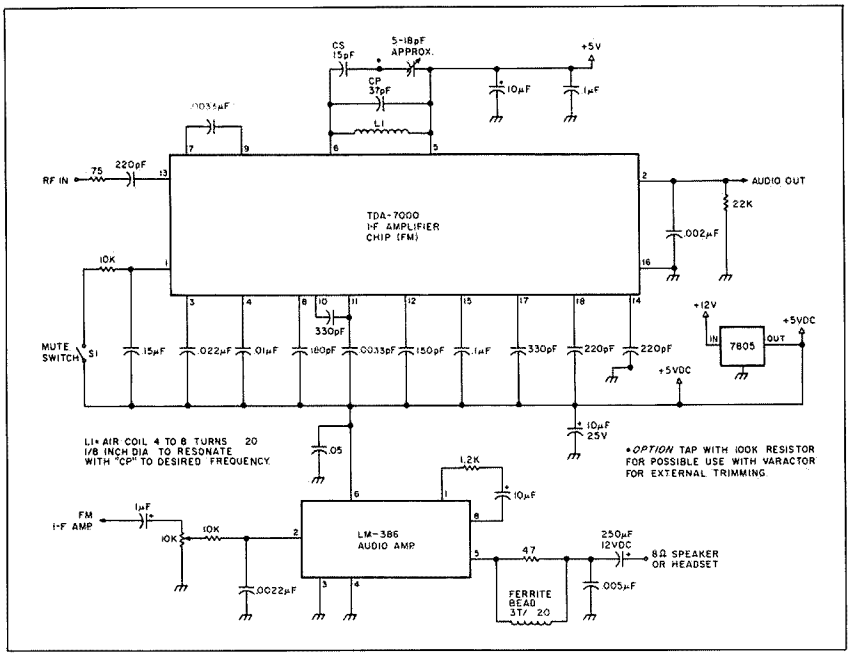


Fig. 3. Schematic diagram for the i-f amplifier.

the ground foil, it raised my previously adjusted frequency some 25%. The sensitivity was just as good as before and nothing was altered except the oscillator frequency. See Fig. 4 for oscillator-coil/capacitor details.

I provided for another set of capacitors—15 pF and a variable 2–18 pF—in series with each other across the coil for those who don't have an adjustable 1/8" coil form. Just use an air-wound coil and it will work very well. If you do not have access to a grid-dip meter, 4–5 turns on any small coil with a 37-pF or so capacitor will bring the i-f oscillator to operation in the 50-MHz range. You can trim to your desired frequency by spreading the coil or using the adjustable capacitor. I used the small coil because it looked right, and I placed the other components on the board to allow universal adaptability out of your junk box for several oscillator configurations.

Checkout

Check the PC board for possible shorts and *only then* apply power to the system. Remember that the chip operates on a minimum of 2.7 volts and a maximum of 10 volts. Do not use this chip on a 12-volt supply without a voltage-dropping network (see Fig. 3). I provided for a +5-volt regulator to reduce the 12-volt system power supply to the required potential for the i-f amplifier.

I could not detect the oscillator output frequency with my grid-dip oscillator when the chip was operating. To get around this, I injected a calibrated signal into the rf port. By observing at what frequency the chip locks you can set the oscillator to obtain the proper frequency by adjusting the coil-capacitor combination. Setting the oscillator coil and capacitor is the only adjustment that is needed. Lock-in range is aproximately 300 kHz.

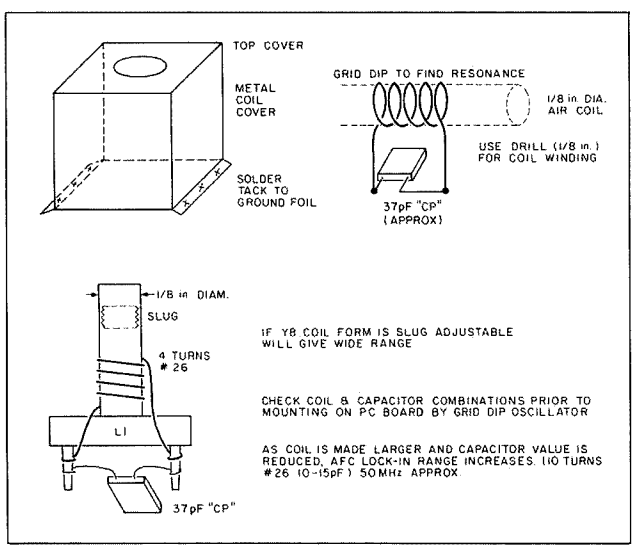


Fig. 4. Some suggestions for winding the local-oscillator coil.

Applications

My first unit was installed on a 10-GHz transceiver (Photo B). The unit was not the familiar Gunnplexer, but rather a modified intrusion alarm detector (a Gunnplexer by another name). The alarm portion was defeated and disconnected and the detector output was modified to accept the i-f amplifier. The detector-output impedance is about 200 Ohms and the input of the amplifier is 75 Ohms. I've got to thank Kerry Banke N6IZW for all of his work on adapting the Gunnplexer, and so many other parts of this project, to the i-f amplifier. Without his help this project wouldn't have gotten off the ground.

We contemplated using a small matching pi network to resonate the input at 30 MHz to improve the match and prevent operation on another frequency (such as 60 MHz). We have not tried this out yet, but field trials will show whether it is needed. We think it might be possible for the frequency-locked loop to sense 60 MHz on a working 30-MHz amplifier, but this would only happen if our frequency, 10 GHz, was not properly set.

I also plan to install one of these boards in my spectrum analyzer, tapping off the existing i-f amplifier. Trial usage showed that operation was quite good. Due to the high sensitivity of the Signetics chip, a 1"-long piece of wire provided the needed coupling to give proper input. Now when I zero a pip on the oscilloscope I can also hear the modulation and be able to identify the signals a lot easier.

By using the amplifier on the workbench, alignment of converters and preamplifiers has been made easy. No longer do I have to disable and move the station receiver to the workbench to make repairs or modifications. I can leave the station connected and even use it on a break from a long building binge. You could even move the oscillator coil up to the commercial FM band and create a garage radio of excellent quality; although it's mono, the quality of audio is very good.

6 Meters

The neatest trick was the construction of a 6-meter monitor for the station. By connecting an external crystal-controlled oscillator to pin 6, I set the oscillator to receive 52.525 MHz. Now, with 3-uV sensitivity, six-meter signals blew the doors off of the receiver. I may construct several more for 2 meters or higher frequencies by placing converters in front of the i-f amplifier. With operation causing such a low current drain on the station's emergency battery pack, several units can be operated and not even dent existing battery operation. However, with the normal station transceivers and synthesizers running, the battery runs down.

I hope I have given you experimenters several good ideas on how to use the Signetics i-f amplifier chip, the TDA-7000. I have had lots of fun and plan to use it in even more applications. I would be happy to correspond with others interested in this project and other items related to microwave applications and test equipment.

A printed circuit board etched and ready for drilling is available from the author for those not desiring to construct one from the artwork provided in this article. The cost is $5 plus postage. ■

Paul Selwa NB9K
61 E. Tilden Drive
Brownsburg IN 46112

The DXer's SCF

Build the ultimate station accessory: a switched capacitor filter for CW and SSB.

Number 7 on your Feedback card

Simple low-pass or high-pass audio filtering has never seemed to be adequate to cope with the noise encountered on the ham bands. While looking through the 1982 *Radio Amateur's Handbook* published by the ARRL, I found information on voice formants and decided to build a crystal-controlled audio Switched Capacitor Filter (SCF) to take advantage of the noise-bandwidth reduction offered by that technique.

Formants are the groups of audio frequency energy that convey spoken intelligence. The voiceprints of courtroom fame are spectrograms of formants. The first formant extends from approximately 300 to 700 Hz, while the second and third span from 1,500 to 2,700 Hz.

The filter's SSB gain from input to output is unity, to allow switching between its output and your receiver's output without volume changes. The filter's response curve is shown in Fig. 1. The 3-dB bandwidth of this unit is 1,680 Hz for SSB mode in two-band segments between 300 and 3,000 Hz, with a bandpass filter (BPF) for the first formant and another BPF for the other two. In CW mode, bandwidths of 300 or 440 Hz can be selected by a front-panel switch.

In my shack, the audio from my Kenwood TS-830 loops through the input of this filter and then connects to the "A" input of my SP-230 external speaker. The output of the filter is connected to the "B" input of the SP-230, which has a front-panel A/B-selecting switch.

Circuit Operation

The SSB BPF sections are formed by cascading high-pass filters (HPF) and low-pass filters (LPF) to produce a BPF response. The particular switched capacitor filter chips used in this project are National Semiconductor MF10s. The MF10 has LPF, BPF, and HPF outputs, but the BPF output has a high enough Q that it cannot produce the desired voice bandwidths. In CW mode, four MF10 BPF outputs are cascaded to produce the narrow response, with a pickoff after the second BPF for the wider response.

To improve the stopband rejection at the lower corners of the SSB BPFs, their input coupling capacitors are chosen to produce additional rolloff below their band segments. All voices vary somewhat in frequency content, and a minor change here from component tolerances does not make a serious difference in intelligibility. Other capacitors are added to the basic application circuit to provide frequency shaping of the total response.

Capacitor C1 provides high-pass filtering

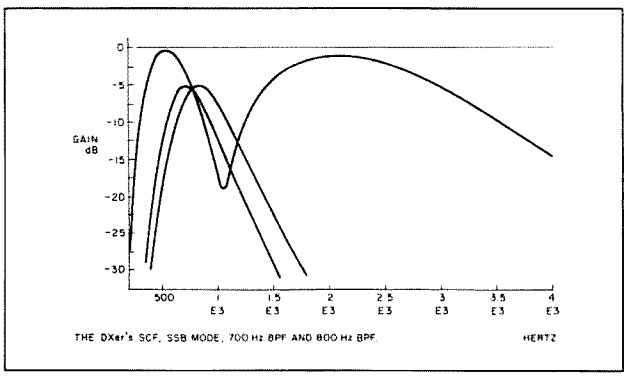


Fig. 1. The filter's response curve.

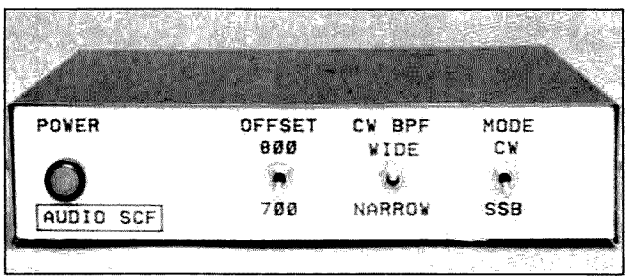


Photo A. The DXer's SCF.

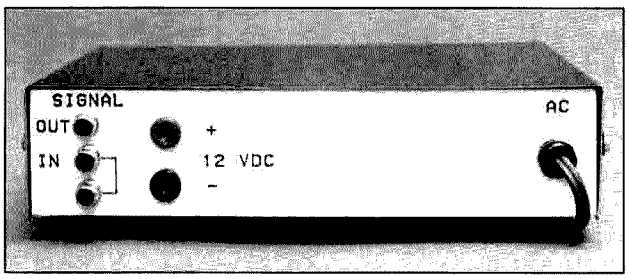


Photo B. Rear panel.

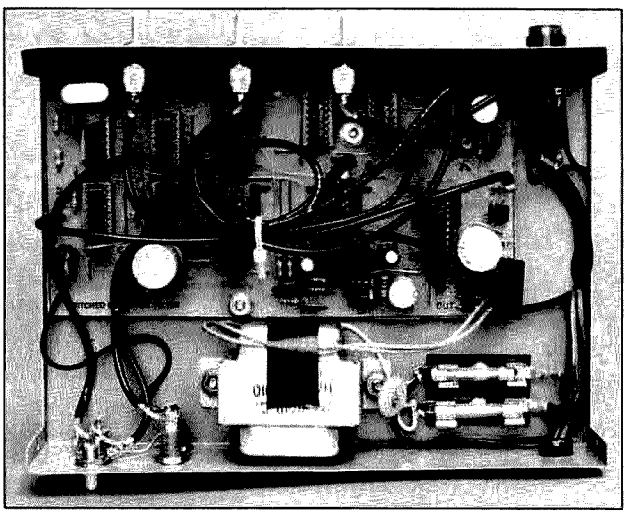


Photo C. Interior.

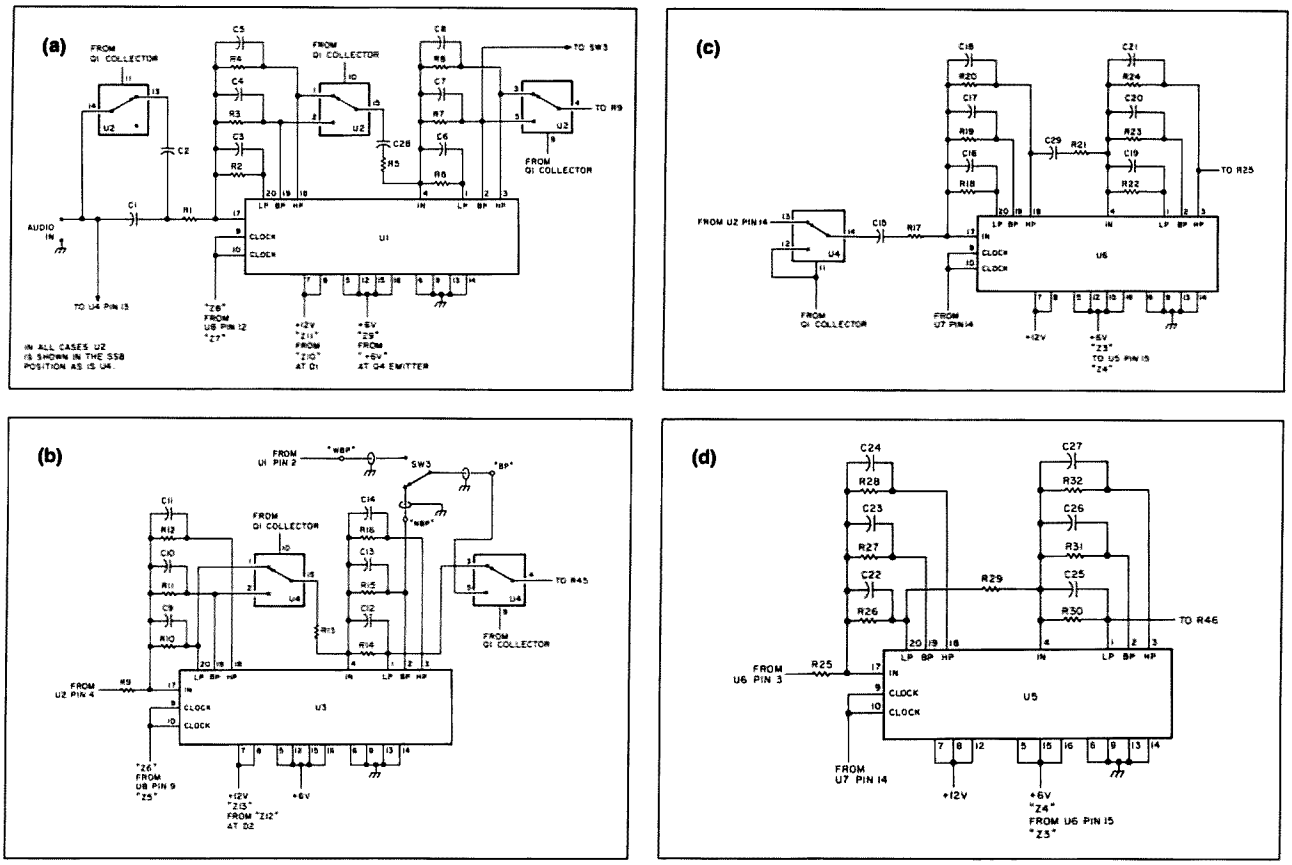


Fig. 2(a)-(d). Four National MF10s are cascaded to produce the desired filter shape.

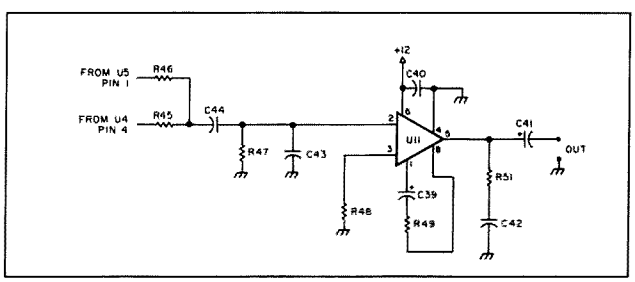


Fig. 2(e). Output driver.

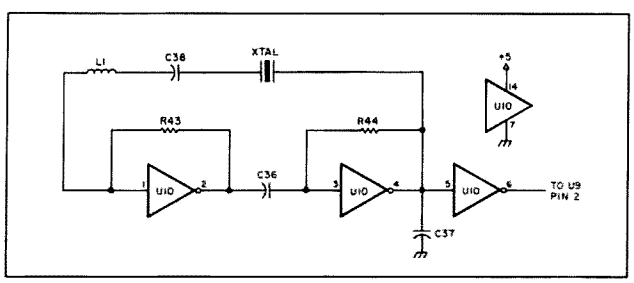


Fig. 2(f). System clock.

for CW mode by reducing response below 700 Hz. In SSB mode, C2 is switched in parallel with C1 to extend the response to below 500 Hz—Fig. 2(a). In the lower formant BPF, C28 provides additional rolloff below 400 Hz. The second formant BPF (U5 and U6) uses C15 and C29 similarly—Figs. 2(c) and 2(d).

The lower formant section is used for the CW filter. Since the bandwidth of the fourth cascaded BPF output is 350 Hz with an 800-Hz offset and is 300 Hz for a 700-Hz offset, it seems unnecessary to add more stages. There is a problem with very narrow CW filters in ease of receiver tuning and with receiver and transmitter drifts, which can require annoyingly frequent retuning of your receiver.

It is interesting to note that in the wide CW filter position you can understand SSB transmissions. While reception is not as clear as in SSB operation of the filter, it does remove a lot of background noise.

The CW BPF is created by switching the original topology of HP-HP-LP-LP to BP-BP-BP-BP via U2 (Fig. 2(a)), U4 (Figs. 2(b) and 2(c)), and Q1 (Fig. 2(i)). Each MF10 contains two filters that account for these HP and LP pairs. To keep the unused higher formant section from contributing noise in CW mode, its input is ac grounded by U4.

The output driver, U11 (Fig. 2(e)), will drive an 8-Ohm load with a 2-V rms signal. U11's gain is 20 without using R49 and C39, giving a total gain of 1:1 for the unit. Additional gain is available if R49 and C39 are added to the board. For example, R49 = 1,200 Ohms yields a gain of 50 in U11. C43 provides the final high-frequency rolloff.

SCF Theory

SCFs are basically integrators that are interconnected to provide HP, LP, BP, and NOTCH functions.

The active LPF, Fig. 3(a), has gain V2/V1 = $-1/(6.28 \times f \times R \times C)$. To show that resistor R can be replaced by switched capacitor C_s (which acts like an equivalent resistor, Req), consider Fig. 3(b).

During the portion of the clock signal that turns on Q1 and turns off Q2, capacitor C_s will acquire charge Q_s. When the clock signal changes state, Q1 will turn off and Q2 will turn on. The current flowing to the op amp will be $I_{in} = Q_s/(\text{unit time})$, where $Q_s = C_s \times V1$. The input current $I_{in} = V1/Req = Q_s/T$, where T is the clock period. Therefore, Req $= (V1 \times T)/Q_s = (V1 \times T)/(C_s \times V1)$, or Req $= T/C_s$.

Again, from Fig. 3(a) we know that V2/V1

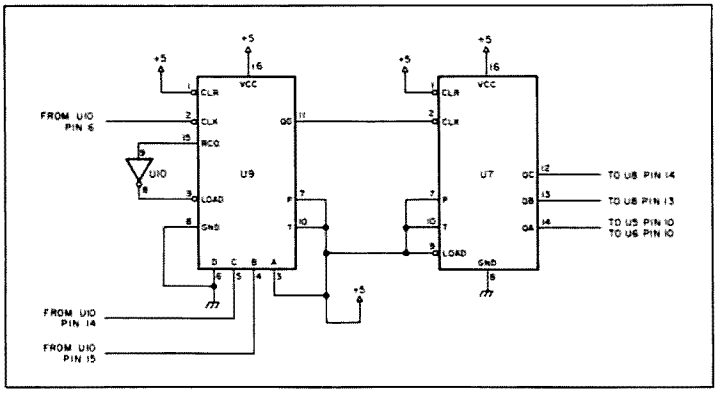


Fig. 2(g). Divider section.

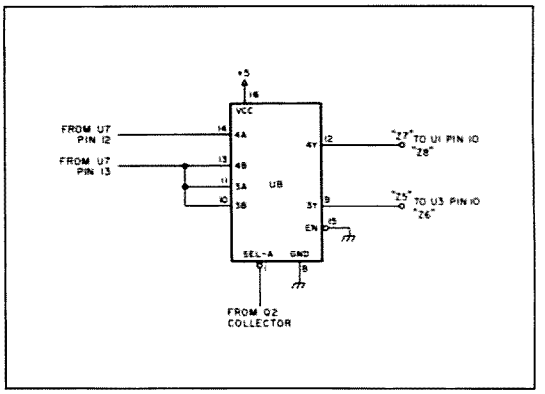


Fig. 2(h). Clock switch.

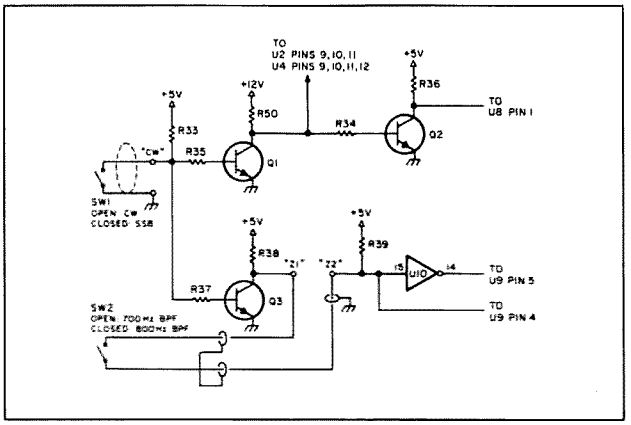


Fig. 2(i). Mode and offset selection.

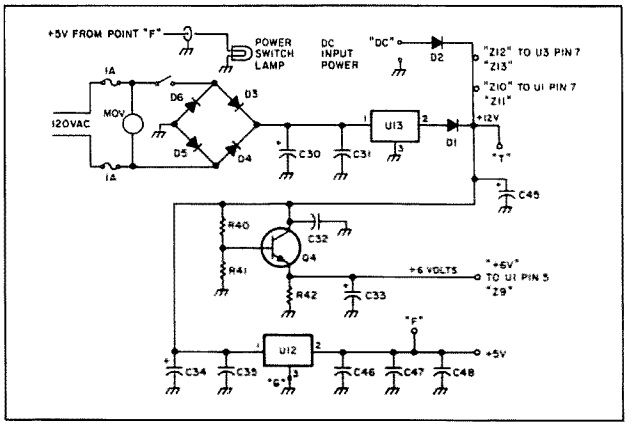


Fig. 2(j). Power supply.

$= -1/(6.28 \times f \times R \times C)$, so substituting Req for R we have $V2/V1 = -1/(6.28 \times f \times C \times T/C_s)$. We can see that R has been replaced by T/C_s and, more importantly, that the ratio of $C \times T/C_s$ is the gain-setting relationship which has replaced C x R.

The absolute values of C and C_s are not as important as their ratio, which can be set to great precision in the SCF chip. The clock can also be generated with high precision, so the main variable in the circuit's gain is the input frequency. A symmetrical clock signal is needed to provide equal charging and discharging time for C_s. There are many sources of data on SCF theory, so I will not go into more detail here.

A look at the MF10 in a data book shows nine different configurations for this versatile IC. The cutoff frequency or the bandpass frequency in each application circuit depends on resistor ratios and on the absolute value of the clock frequency. To keep the resistor ratios under control, along with their cost, I use resistor packs for these components. The absolute value of the R-packs is not as important as the ratio between the resistors on a given half of an MF10. This ratio in the R-packs is on the order of 0.5%.

Clock Generator

The clock is based on a 3.58-MHz crystal oscillator, U10, which is divided down by binary counters U9 and U7—Fig. 2(g).

SSB Clock

There is almost a harmonic relationship between the formants, and that fact is used to advantage in simplifying the clock generator.

The programmable divider, U9, is preloaded to 3 for a dividing ratio of 13 in SSB mode. The terminal count of the chip is 16, at which time the CARRY OUTPUT, pin 15, enables the LOAD pin via an inverter and loads the preset count at the next positive edge of the 3.58-MHz clock. The CARRY OUTPUT at 3.58/13 MHz is also used to clock U7, which is a binary counter producing the divide-by-2 and divide-by-4 ratios mentioned later.

In SSB mode, the 3.58-MHz signal is divided by 13 in U9 and then by 2 in U7 to produce a 137,674-Hz clock signal for the upper formant BPF.

An MF10 can be set for a clock/corner frequency ratio of 50 or 100. In the upper formant BPF, the X100 section, U5, has a passband starting at 1,376 Hz—Fig. 2(d). The following LPF section, U6, with its X50 ratio, has a passband ending at 2,753 Hz—Fig. 2(c). These two filters form a BPF from 1,376 to 2,753 Hz.

The lower formant BPF is wired for clocking at the X100 ratio in both U1 (Fig. 2(a)) and U3 (Fig. 2(b)) to simplify the switching between SSB and CW operation. To obtain the proper SSB clocks for the lower formant, the 137,674-Hz signal is divided by 2 for U3 and by 4 for U1 to yield 68,837 and 34,418 Hz, respectively, and a BPF of 344 to 688 Hz.

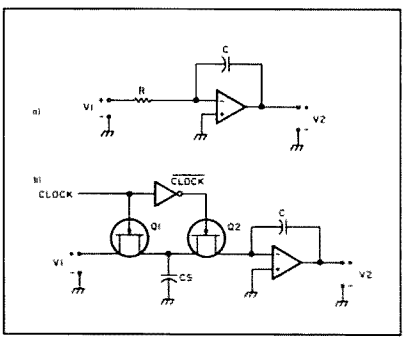


Fig. 3. The switched capacitor filter is derived from a simple active low-pass filter.

CW Clock

The lower formant BPFs, U1 and U3, require identical clock signals in CW mode, which are selected in U8 (Fig. 2(h)) as controlled by Q2 (Fig. 2(i)).

The two most popular CW offsets are 700 Hz and 800 Hz, which can be selected by switch SW2. In the case of a 700-Hz offset, the divider ratios are 13 and 4, which yield a 68,837-Hz clock signal. The X100 setup

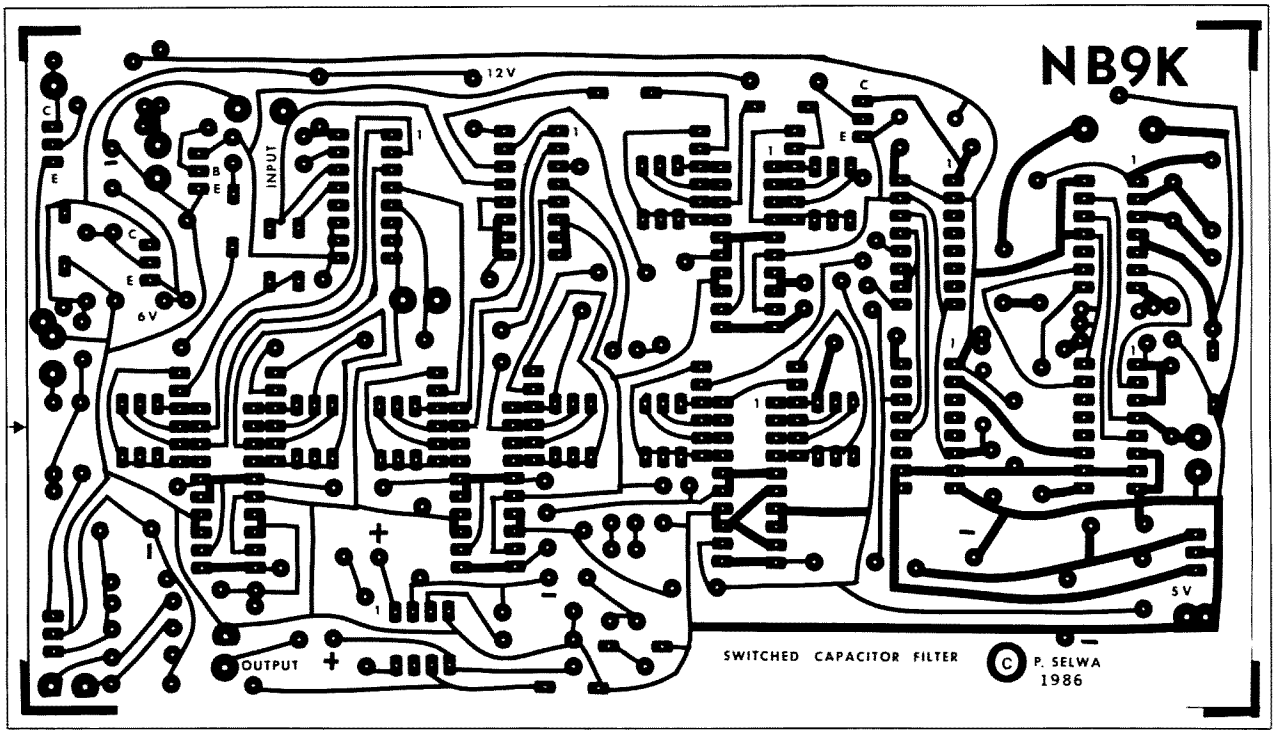


Fig. 4. Circuit board, foil side.

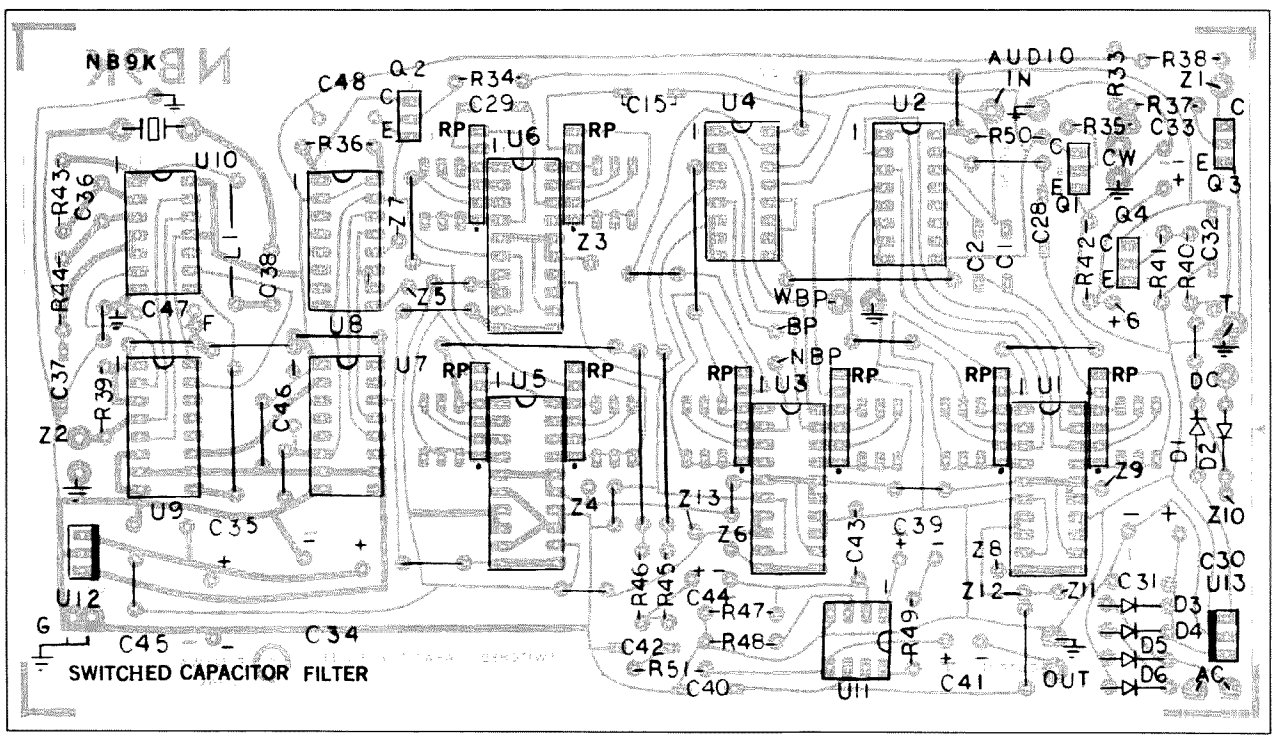


Fig. 5. Parts placement.

results in a 688-Hz BPF. If an 800-Hz offset is chosen, the dividers are 11 and 4 to produce a clock frequency of 81,353 Hz. The coupling caps for U1 cause the total response to peak at 732 and 846 Hz, but the response at 700 and 800 Hz is less than 0.2 dB down from maximum.

The clock signal for the upper formant gets changed during CW operation at 800 Hz since divider U9 (Fig. 2(g)) is set to 11 rather than to 13. The audio input to the upper formant BPF is ac grounded at U4 pin 14 (Fig. 2(c)) during CW mode so the output stage is not affected. Without this muting, the upper formant filter would produce interference acting as a BPF from 1,627 to 3,254 Hz.

Power Supply

The power supply is a conventional transformer/diode bridge/regulator combination. The 12-V regulator's output passes through

Parts List

C1, C28	0.018 uF
C2, C36	0.01 uF
C31, C32, C35, C40, C46, C47, C48	0.1 uF
C3–C14*	
C15	0.0039 uF
C16–C27*	
C29	0.0027 uF
C30, C34, C45	220 uF, 50 V
C33, C41	100 uF, 25 V
C37*	10 pF
C38*	180 pF
C39**	10 uF, 25 V
C42	0.047 uF
C43	0.15 uF
C44	2.2 uF, 25 V
D1–D6	1N4002
L1*	10 uH
Q1–Q4	2N2222 or 2N3904
RP1–RP8 (R1–R32)	Resistor SIP 5@ 22 k Digi-Key #Q5223
R33, R34, R36, R38, R39	10 k, 1/8 W
R35, R37, R48, R50	1 k, 1/8 W
R40, R42	4,300 Ohm, 1/8 W
R41	5,600 Ohm, 1/8 W
R43, R44	820 Ohm, 1/8 W
R45	24,000 Ohm, 1/8 W
R46	7,500 Ohm, 1/8 W
R47	1,600 Ohm, 1/8 W
R49**	1,200 Ohm, 1/8 W
R51	10 Ohm, 1/8 W
SW1, SW2	SPST toggle switch
SW3	SPDT toggle switch
U1, U3, U5, U6	MF10CN
U2, U4	CD4053B
U7, U9	74C163
U8	74C157
U10	74LS04
U11	LM386N
U12	LM7805CT
U13	LM7812CT
XTAL	3.58-MHz crystal
Transformer*	18-V rms @ 600 mA All Electronics—TX-186 Radio Shack—273-1515
Heat sink (for U12)	RS 276-1367
Fuse holders	RS 270-739
Power switch	RS 275-677
Cabinet	RS 270-272
Fuses	1 Ampere
3 phone jacks	
2 banana jacks	
Metal-oxide varistor	

* see "Assembly" section.
** see "Circuit Operation" section.

BUILD THE KIT

A complete set of parts, including everything required to build the kit, is available from Valley Electronics. The kit version is slightly different from the unit presented in this article. The kit includes the "optional" capacitor and resistor for additional gain, a headphone jack, and a filter in/filter out switch. The circuit board is double-sided, and the entire unit is housed in an attractive cabinet with wood-grain end panels.

Order Number	Description	Price
98601	Complete SCF Kit	$119.95

The price includes shipping and handling.

Send your check or money order to Valley Electronics, PO Box 1101, Hillsboro NH 03244.

diode D1, which protects the regulator from externally applied voltages—Fig. 2(j). An external dc power supply can be applied to the unit at point "DC" via diode D2 in the case of battery operation, or from the accessory socket on another piece of equipment. D2 protects against polarity reversals. You can apply an external dc supply through the diode bridge, but this requires about 17 volts to get regulated +12 volts. This unit draws about 75 mA dc with no signal applied. For low-level audio applications such as for headphones, a 12.6-volt transformer is enough to power the unit. For full capability, however, use an 18-volt power transformer. The +6-volt supply is for biasing the internal amplifiers in the MF10. Its exact value is not critical.

Assembly

There are no adjustments and there is nothing critical about assembling this project. All components are available from sources such as Digi-Key, Jameco, All Electronics, and Radio Shack.

The selection of CW or SSB mode is made by grounding point CW on the board with switch SW1 for SSB mode, or letting it pull up via R33 for CW mode—Fig. 2(i). The default CW filter is at 700 Hz, and you can select the 800-Hz BPF by connecting points "Z1" and "Z2" with switch SW2. Select the narrow or wide CW BPF by connecting SPDT switch SW3 to points NBP, WBP, and BP with the pole at BP. In addition to the jumpers shown as straight lines on the parts placement diagram, connect the points: Z3–Z4 (Figs. 2(c) and 2(d)), Z5–Z6 (Figs. 2(b) and 2(h)), Z7–Z8 (Figs. 2(a) and 2(h)), +6–Z9 (Figs. 2(a) and 2(j)), Z10–Z11 (Figs. 2(a) and 2(j)), and Z12–Z13 (Figs. 2(b) and 2(j)). Point "F" is a +5-volt pickoff and point "T" is a +12-volt pickoff for pilot lights—Fig. 2(j).

To avoid hum problems, use shielded wire wherever possible. There is a point to ground the crystal's can, and there are holes near U12 labelled "G" to use in making ground connections—Fig. 2(j). I had to connect from "G" to ground at the rear-panel output jack to take out hum.

Space is provided for an LC resonant circuit (L1, C38) in series with the crystal in case yours requires it to operate correctly; otherwise, jumper their spaces—Fig. 2(f). Add C37 to aid in oscillator startup as required.

There is room for IC sockets, and the spaces for the resistor SIP packs are laid out so they can be inserted in either direction, but the dot on the component layout marks the common point (the MF10's input summing junction). Capacitors C3–C14 (Figs. 2(a) and 2(b)) and C16–C27 (Figs. 2(c) and 2(d)) are shown on the schematic and there are holes on the board for them, but they are there for experimentation and the unit works fine without them. Check a data book for the internal schematic of the MF10 before adding any of those caps.

The 12-V regulator requires a heat sink, but the 5-V regulator does not unless you use TTL equivalents in the clock generator. ■

Kenneth Hand WB2EUF
PO Box 708
East Hampton NY 11937

One Band, One Transistor

Build this tiny ham band receiver and put the world in your pocket.

Number 8 on your Feedback card

Here is a very simple little receiver that most anyone electronically inclined can build. You can use it to listen to your favorite ham band when you're away from the shack.

The circuit in Fig. 1 is configured for the 80m band. All of the parts can be found in your local Radio Shack store. A good way to build this project would be to use a single-sided printed circuit board. Additionally, you will need either a 9-volt or a 12-volt battery, an audio amp module (you can build your own using a 741 IC; I will send a wiring diagram to you for an SASE), and 8-Ohm headphones. The 365-pF broadcast-band variable capacitor should have a vernier drive (six-to-one ratio), which makes tuning easier by separating the stations on the dial. A good antenna and ground are also recommended.

With just a few changes in capacitance and inductance values, this receiver should work well on other ham bands. For example, you could install the receiver in a broadcast-band transistor radio. Instead of using an external audio amp, you would use the one in the radio—just run a wire from the wiper of the 10k volume control to the middle terminal of the volume control in the broadcast receiver. You should connect the grounds of the two radios together. The 9 or 12 volts needed to power the one-transistor radio would be taken from the on/off switch on the back of the volume control.

The Radio Shack iron-core chokes (276-101) that are used in the bfo part of the circuit can be calibrated by listening for the bfo signal in a calibrated receiver. This bfo coil is placed in a horizontal position in relation to the copper foil of the printed circuit board, and the distance between the side of the bfo coil and the copper foil of the printed circuit board determines the band edge's low and high limits. Tuning of the bfo coil is accomplished by varying the distance between the side of the bfo coil and the copper foil. The inductance value of the bfo coil is 10 mH.

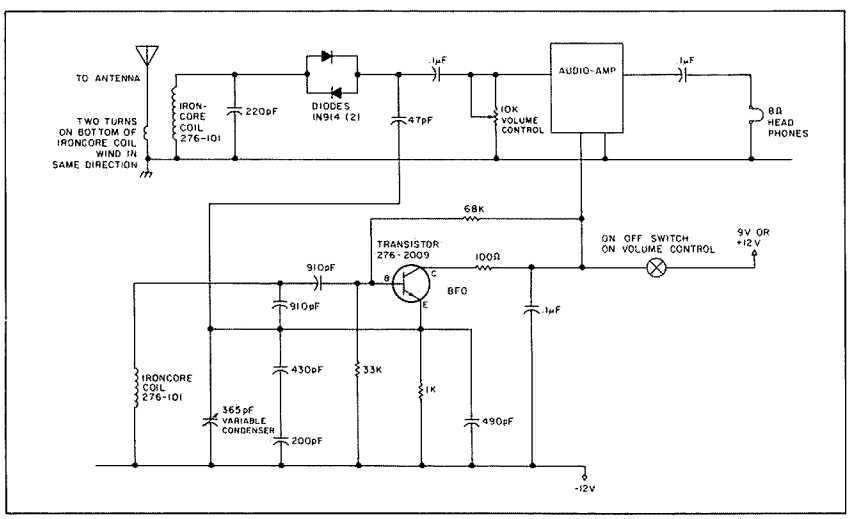


Fig. 1. This tiny single-band receiver will fit into your pocket.

"With just a few changes in capacitance and inductance values, this receiver should work well on other ham bands."

This one-transistor receiver also could be made into a very small pocket ham-band receiver, which would be good for SWLs and hams to listen to when away from home, to keep in touch with their favorite nets and skeds. It may be possible to increase the volume by installing a small output transformer (500 to 8 Ohms) between the output terminals on the other side of the .1-uF capacitor. Run the 500-Ohm side to the capacitor and ground, and the 8-Ohm side to the 8-Ohm headphones.

I hope you enjoy building and operating this simple receiver. If you have any questions, you can write to me at the address at the beginning of this article. ■

SPECIAL EVENTS

WEST COVINA CA
OCT 4

The Southern California Amateur Transmitting Society will sponsor Scatcon '86 on October 4, from 9 a.m. to 3 p.m., at Cortez Park, 2441 Cortez Avenue, West Covina, California. $2 donation. Talk-in on 147.765/.600. For more information, call Bob N6NGN at (818)-917-6470.

NORWOOD NJ
OCT 4

The Orange County ARC will hold its hamfest and auction on October 4, from 9 a.m. to 3 p.m., at John S. Burke Catholic High School. Admission is $3. Tables $7, tailgating $3. License exams begin at 9 a.m. Talk-in on 146.76 and 146.52. For more information, call Bob WB2ENA at (201)-767-6698.

CINCINNATI CLUB 50TH
OCT 4

The Greater Cincinnati ARA invites all amateurs to work club station W8DZ to help them celebrate 50 years of service. Frequencies just inside the General phone bands and 45 kHz up on CW will be used. For a facsimile stock certificate of one share of Cincinnati, send QSL, address label, and a 22-cent stamp to W8GS, 620 Woodsway Drive, Loveland OH 45140.

WARRINGTON PA
OCT 4–5

The Pack Rats (Mt. Airy VHF ARC) will hold the 10th annual Mid-Atlantic VHF Conference on October 4 at the Warrington Motor Lodge, and the 15th annual Pack Rat Hamarama on October 5 at the Bucks County Drive-In Theater, Rte. 611, Warrington, Pennsylvania. Admission to the flea market is $5 per carload, with selling spaces $6 each. The gate will open at 6 a.m. Bring your own tables. Advance registration for the conference is $4. Send payment to Hamarama '86, PO Box 311, Southampton PA 18966, or call Pat Cawthorne WB3DNI at (215)-672-5289.

SPRINGFIELD OH
OCT 5

The Independent Radio Association will hold its 4th annual Springfield, Ohio, Hamfest and Computer Expo on October 5, from 8 a.m. to 4 p.m., at Clark County Fairgrounds, a quarter mile west of the intersection of I-70 and Ohio Rte. 41 (Exit 59). Admission is $3, $2 in advance, children under 12 free. Tables are $7, $6 in advance. Talk-in on 145.45. For advance reservations, write the Independent Radio Association, PO Box 523, Springfield OH 45501, or call Steve KA8QCS at (513)-882-6521.

ST. JOSEPH MI
OCT 5

The Blossomland ARA will hold its Blossomland Blast on October 5. For more information, write "Blast," PO Box 175, St. Joseph MI 49085.

COLUMBIA MD
OCT 5

The Columbia ARA will hold its 10th annual hamfest on October 5, from 8 a.m. to 3:30 p.m., at the Howard County Fairgrounds (15 miles west of Baltimore just off I-70 on Rte. 144, one mile west of Rte. 32). Admission is $3, XYLs and children free. Tables are $7 if payment is received by Sept. 30, $8 afterwards. Outdoor tailgating $3, indoor tailgating $6. Talk-in on 147.735/.135 or 146.52. For table reservations and information, contact Mike Vore W3CCV, 9098 Lambskin Lane, Columbia MD 21045; (301)-992-4953.

YONKERS NY
OCT 5

The Yonkers ARC will sponsor the Yonkers Electronics Fair and Flea Market on October 5, from 9 a.m. to 4 p.m., at the Yonkers Municipal Parking Garage (corner of Nepperhan Avenue and New Main Street). Admission is $3, children under 12 free. Sellers, $7 per parking space. Talk-in on 146.865, 440.150, and 146.52. For further information, contact YARC, 53 Haywood Street, Yonkers NY 10704; (914)-969-1053.

ROME GA
OCT 5

The Coosa Valley ARC will hold the Rome, Georgia, Hamfest on October 5 at the Rome Civic Center on GA 20, across from Shoney's. Admission is free. Inside tables $5, outside spaces $2. Exams begin at 8 a.m. For more information, contact Bobbie Carol Waller KA4DXU, 24 Wellington Way, SE Rome GA 30161; (404)-235-5417.

ALFALFA COUNTY OK
OCT 5

The Salt Plains ARC will hold its annual Ham Social on October 5 at Salt Plains Lake in northern Alfalfa County, Oklahoma. Talk-in on 147.30/.90.

CORRECTIONS

In the QRP column in the July, 1986, issue (p. 83): The table on the left shows "Lengths of quarter-wavelength ground radial wires"; the table on the right shows "Resonant lengths of wire."

An error crept into Tom Miller's universal frequency display, "What You See Is Where You're At: Part II," in the May, 1986, issue. Please add an extra divide-by-ten stage as shown in Fig. 1.

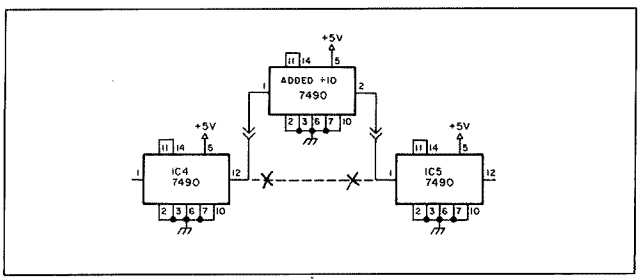


Fig. 1. Schematic addition for "What You See Is Where You're At: Part II."

SATELLITES

Number 27 on your Feedback card

USING THE AO-10 PREDICTIONS

Apogee predictions for the month of October are provided for three sections of the United States: Washington, D.C.; Denver, Colorado; and Los Angeles, California. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
October 1986

		WASH		DENVER		LA	
DAY	TIME	AZ	EL	AZ	EL	AZ	EL
2	1030	242	3	219	20	207	31
3	0949	235	10	209	24	195	34
4	0908	227	16	199	27	183	36
5	0827	219	21	188	29	171	35
6	0746	209	25	176	30	159	33
7	0705	199	29	165	29	148	30
8	0624	188	31	154	26	138	25
9	0543	176	31	144	22	130	19
10	0502	164	30	135	17	122	12
11	0421	153	27	127	12	116	5
12	0340	143	23	120	6		
13	0259	134	18	113	0		
14	0218	126	12				
15	0137	119	6				
16	1236					246	5
17	1155			247	0	239	12
18	1114			241	6	232	19
19	1033			234	13	224	25
20	0952	248	0	226	18	215	30
21	0911	241	7	217	24	204	35
22	0831	234	14	207	28	192	37
23	0750	226	19	196	31	179	38
24	0709	217	25	184	32	166	37
25	0628	207	29	172	32	154	35
26	0547	196	32	160	30	143	30
27	0506	184	34	149	27	134	25
28	0425	171	33	140	23	125	18
29	0344	160	31	131	17	118	12
30	0303	149	28	123	11	112	4
31	0222	139	24	116	5		

Send inquiries to Gary Gerber KBØHH, 511 S. Lincoln, Anthony KS 67003; (405)-842-5076.

ROCK HILL SC
OCT 5

The York County ARS will hold the Rock Hill Hamfest on October 5, beginning at 7 a.m., at Joslyn Park on Lake Wylie, in Rock Hill, South Carolina. Pre-registration is $3, $4 at the gate. Talk-in on 146.43/147.03. For more information, contact J. George Trunk N4MCJ, 1158 Wendy Road, Rock Hill SC 29730; (803)-327-4344.

VIRGINIA BEACH ARC 25TH
OCT 5–6

The Virginia Beach ARC invites all hams to help celebrate its 25th anniversary by contacting club station WA4TGF on October 5–6. Operation will be on the following frequencies, ±5 kHz: CW—3.540, 7.040, 14.040, 21.040, and 28.040; SSB—3.890, 7.240, 14.250, 21.340, and 28.560. To receive a special 8 x 10 QSL certificate, send a 9 x 12 envelope and two first-class stamps to R. C. Brown, VBARC, 4821 Rosecroft Street, Virginia Beach VA 23464.

WASECA MN
OCT 11

The Viking ARS will hold its 16th annual swapfest at the Waseca High School on Saturday, October 11. Doors open at 8 a.m. ARRL VEC testing, walk-ins only. Talk-in on .34/.94. Contact VARS, PO Box 3, Waseca MN 56093.

COLUMBUS EVENTS
OCT 11–12

The Columbus ARA will hold the Fourth Annual Columbus Day Special Event on October 11–12 as a triple salute to explorer Christopher Columbus, the city of Columbus, Ohio, and amateur radio worldwide. CARA club station W8TO will operate as a citywide special-event station. For a complete list of rules, write to Amateur Radio Station W8TO, Attn. Special Event Coordinator, 280 East Broad Street, Columbus OH 43215.

IKE B'OAY
OCT 11–12

The Texoma ARC will operate special-event station K5GQD from Denison, Texas, birthplace of President Dwight D. Eisenhower, to commemorate the 96th anniversary of his birth. Operation will be from 1400 UTC October 11 until 2400 UTC October 12 on SSB in the General-class portions of the 2-, 10-, 15-, 20-, 40-, and 75-meter bands. For an 8-1/2 x 11 certificate, send a QSL and a large SASE to K5GQD, 1303 E. Richards, Sherman TX 75090.

MEMPHIS TN
OCT 11–12

The Mid-South ARA and allied clubs will hold their annual hamfest at a new location this year, at the Shelby County Agricenter, from 8 a.m. to 5 p.m. on October 11 and from 9 a.m. to 4 p.m. on October 12. Directions: Poplar Ave. to Germantown (Germantown Road), north about 6 miles; or take Exit 13 on I-240 (Walnut Grove) and go east. Flea-market spaces are $6 each per day, tables provided. Non-ham XYLs and children admitted free. Exams will begin at 9 a.m. on Saturday. Talk-in on .28/.88 or .22/.82. For further information, contact Clayton Elam K4FZJ, 28 North Cooper, Memphis TN; (901)-274-4418 (days) or (901)-743-6714 (nights).

WICHITA KS
OCT 11–12

The Kansas ARRL Convention will be held October 11–12 at the Holiday Inn Plaza, 250 W. Douglas, Wichita KS 67202. The convention opens at 9 a.m. both days. $5 pre-registration, $6 at the door, non-amateurs $3. VE exams given. Talk-in on 146.82. WØSOE is the official talk-in station. For more information, contact Kansas ARRL Convention, Clarence Reid KØBHJ, 1520 W. 16th, Wichita KS 67203.

WARNER ROBINS GA
OCT 11–12

The Central Georgia ARC will sponsor the 8th annual Central Georgia Hamfest and the 1986 Georgia State ARRL Convention on October 11–12, from 8 a.m. to 5 p.m. on Saturday and from 8 a.m. to 3 p.m. on Sunday, at the Warner Robins Recreation Center, 800 Watson Blvd., Warner Robins, Georgia. Admission is free. Plenty of tailgate space. Exams given both days at 9 a.m. Talk-in on 146.25/.85. For more information, write to CGARC, PO Box 2585, Warner Robins GA 31099.

TEXAS HERITAGE
OCT 11–18

A mobile special-event station (using callsigns N5IWA, N5OUK, and KA5JHT) will be operating on October 11–18 in conjunction with the Texas Heritage Excursion Rallye (T.H.E. Rallye), which is a Texas Sesquicentennial activity sponsored by the Pro-Texas Foundation and the Sports Car Club of America. Stations will be operated on the Novice segments of the 40- and 80-meter bands and on the General segments of the 20-, 40-, and 80-meter bands. For a commemorative QSL, send a QSL and an SASE to Hal Collins KA5JHT, PO Box 473068, Garland TX 75047-3068.

LIMA OH
OCT 12

The Northern Ohio ARC will hold its annual Allen County Hamfest on October 12, at Allen County Fairgrounds in Lima, Ohio, located one mile east of I-75, Exit 125A, on State Rte. 309 or 117. Tickets are $3 in advance or $3.50 at the door. $6 for a full table, $3.50 for a half table. Talk-in on 146.67 and 146.52. Exams given. For more information or reservations, send an SASE to NOARC, Box 211, Lima OH 45802.

PUMPKIN FESTIVAL
OCT 15–18

The Teays ARC will operate special-event station WB8PPH on October 15–18 to commemorate the annual Circleville Pumpkin Festival. Operation will be in the General phone bands for the following times: October 15, 1700–0100 UTC; October 16–18, 1500–0100 UTC. For a commemorative certificate, send a QSL and an SASE to Len Campbell WB8PPH, 8951 State Route 188, Circleville OH 43113.

NBS 85TH
OCT 17–18

The Bureau Radio Amateur Signal Society (NBS BRASS) will operate special-event station K3AA from 2100–0200 UTC on October 17 and from 1300–0100 UTC on October 18, from the grounds of the National Bureau of Standards, in celebration of the 85th anniversary of the founding of the Bureau. Frequencies: phone—3.900, 7.235, 14.235, and 21.360; CW—3.535, 3.710, 7.035, 7.110, 14.035, 21.035, and 21.110; packet—20m. For a commemorative certificate, send a large SASE to NBS BRASS, National Bureau of Standards, Gaithersburg MD 20899.

SYRACUSE NY
OCT 18

The Radio Amateurs of Greater Syracuse will hold its 31st hamfest on October 18, from 9 a.m. to 5 p.m., in the Arts and Home Mansion at the New York State Fairgrounds, just two miles east of Thruway Exit 39 on Rte. 690. Admission is $4, children under 12 free. Tailgating $3 per car. Indoor flea market $6 per table. Talk-in on 146.31/.91 and 147.90/.30. Exams begin at 12 noon. For more information, call Ed Swiatlowski WA2URK at (315)-487-3417 or Viv Douglas WA2PUU at (315)-469-0590, or write RAGS, PO Box 88, Liverpool NY 13088.

JAMBOREE ON THE AIR
OCT 18–19

The World Bureau of the World Organization of the Scout Movement will sponsor Jamboree On The Air, an annual scouting/ham radio event, from 0001 local time on October 18 to 2400 local time on October 19. Look for K2BSA, the BSA headquarters station in Ft. Worth, Texas, and for HB9S, the World Scout headquarters in Switzerland, and for other special callsigns from many countries. Frequencies: CW—3.590, 7.030, 14.070, 21.140, and 28.190; voice—3.940, 7.290, 14.290, 21.360, and 28.990; packet, RTTY, SSTV, and ATV on usual frequencies. Check the Novice frequencies. K2BSA will be operating on OSCAR 10. Postcard-sized certificates are available free to all participants and may be ordered beforehand for presentation during JOTA. Send requests to Jamboree on the Air Certificates,

BUILD THE DXER'S SCF

A complete kit to build the switched capacitor filter featured on page 46 is available from Valley Electronics. This kit version includes the "optional" capacitor and resistor for additional gain, a headphone jack, and a filter in/filter out switch. The circuit board is double-sided, and the entire unit is housed in an attractive cabinet with wood-grain end panels.

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↙79

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ST. CHARLES IL
OCT 18–19

The Fox River Radio League will sponsor an ARRL Central Division Convention as part of its Hamtastic Weekend on October 18–19, from 10 a.m. to 4 p.m on Saturday and from 9 a.m. to 2 p.m. on Sunday, at the new Norris Sports Center, just off Rte. 64 in St. Charles, Illinois, 35 miles west of Chicago. Tickets good for both days are $3 in advance or $4 at the door. Exams will be given. Talk-in on 144.870/145.470 and 144.610/145.210. For advance tickets or for information on tables or exams, contact Bill Heimann WD9WE, 837 Lebanon Street, Aurora IL 60505; (312)-859-1171. Include an SASE.

ST. PETERSBURG FL
OCT 18–19

The Florida Gulf Coast Amateur Radio Council presents the ARRL South Florida Section Suncoast Convention on October 18–19, from 9 a.m. to 4 p.m., at the National Guard Armory in St. Petersburg, Florida. The convention hotel is the Holiday Inn I-275. Admission is $4 in advance, $5 at the door. Swap tables are $12 for both days. Flea-market area and all exhibits are indoors. For further information, write to FGCARC, PO Box 157, Clearwater FL 33517.

LAKE TEXOMA OK
OCT 24–26

The Texoma Hamarama Association will hold its Hamarama '86 on October 24–26 at Lake Texoma Lodge on Catfish Bay, in Lake Texoma, Oklahoma, near Kingston. Exams will be given. For additional information, contact Texoma Hamarama Association, PO Box 610892, DFW Airport TX 75261.

POQUETANUCK CT
OCT 25

The Tri-City ARC will hold its fourth annual auction on October 25, beginning at 10 a.m., at the St. James Parish Hall, Poquetanuck, Connecticut, 1-1/2 miles east of Rte. 12 on Rte. 2A (south of Norwich). Free admission. Talk-in on 146.52. Call WA2RYU at (203)-464-6555 for further information.

BARBECUE FESTIVAL
OCT 25

The Healing Springs Mtn. VHF Society will operate special-event station WD4BBQ on October 25, from 1300–2100 UTC, for the 3rd annual Lexington Barbecue Festival. Operation will be on 40m, 20m, and 15m. Phone: 25 kHz up from the edge of the General-class band. Novice band: 7.125 as time permits. Also area 2m repeaters. For a special Bar-B-QSL, send an SASE to Healing Springs Mtn. VHF Society, PO Box 41, Lexington NC 27293-0041.

LONDON ONT
OCT 26

The London ARC will hold a flea market on October 26 from 9 a.m. to 2 p.m. Admission is $2, $3 for vendors. Talk-in on 147.060. For more information, contact London ARC, c/o John Pedersen VE3MGR, PO Box 82, Stn. B, London, Ontario N6A 4V3 Canada; 472-6506 after 6 p.m.

FRAMINGHAM MA
OCT 26

The Framingham ARA will hold its annual fall flea market and exams on October 26, beginning at 10 a.m., at the Framingham, Massachusetts, Civic League building, 214 Concord Street (Rte. 126). Admission is $2. Tables $10 (includes one free admission). Talk-in on .75/.15. Pre-registration required for tables and exams. Contact Jon Weiner K1VVC, 52 Overlook Drive, Framingham MA 01701; (617)-877-7166.

KALAMAZOO MI
OCT 26

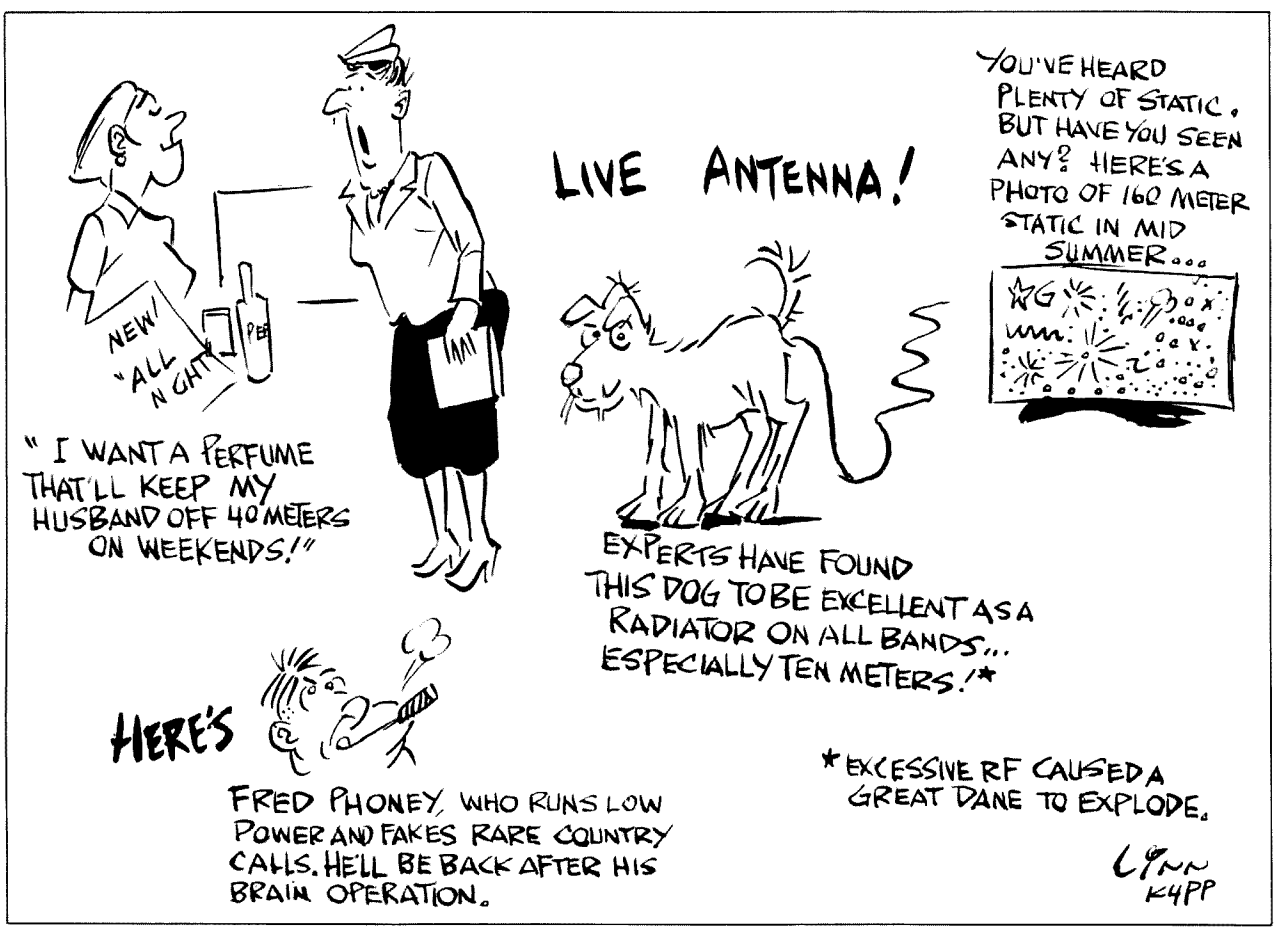
The Kalamazoo ARC will hold its 4th annual Hamfest and Radio Swap on October 26, from 9 a.m. to 2 p.m., at the Kalamazoo County Fairgrounds, 2900 Lake Street, Kalamazoo, Michigan (halfway between Chicago and Detroit). Admission is $2 in advance, $2.50 at the door. Talk-in on 147.00+. 8-foot table space $6. For reservations, contact Ken KA8RUA, 2825 Lake Street, Kalamazoo MI 49001; (616)-345-4609 (work). Exams given. For information, contact Al Nelson K8OQB, 10603 Cora Drive, Portage MI 49081; (616)-323-3812.

MARION OH
OCT 26

The Marion ARC will hold its 12th annual Heart of Ohio Ham Fiesta on October 26, from 8 a.m. to 4 p.m., at the Marion County Fairgrounds Coliseum. Tickets are $3 in advance, $4 at the door. Tables $5. Talk-in on 146.52 or 147.90/.30. For more information, tickets, or tables, contact Ed Margraff KD8OC, 1989 Weiss Avenue, Marion OH 43302; (614)-382-2608.

LAS VEGAS NV
NOV 7–8

HAM/WEST and the ARRL Nevada State Convention, will be held all day November 7 and 8 at the Hacienda Hotel in Las Vegas, Nevada. Advance registration is $12 before October 24 or $15 at the door. For all info, see the ad in this issue or contact HAM/WEST, PO Box 19675, Las Vegas NV 89132; (702)-361-3331.



NK6K > PACKET

Number 22 on your Feedback card

Harold Price NK6K
1211 Ford Avenue
Redondo Beach CA 90278

HOW FAST IS 2400?

Well, instead of being on the air, I'm sitting here talking to you. It's not entirely your fault, though, since there are several other things I'm behind on. Besides, I still haven't cleaned the dirt out of the key that I/O the dog is playing with on page 84 of the August issue, and that's the only key I own. For the record, I/O remains uncertain about the future of CW, and dug the key up again.

Speaking of the big *73* packet issue, as I write this, I haven't seen it yet. I hope you liked it, and I hope you filled out the bingo card to tell us which articles you liked most and sent it in so I'll have an idea of what you want to see more (or less) of in the way of packet.

I learned several things while working on that issue, the foremost being never to be specific about the launch date of a satellite in a publication with a longer than two-day lead time. While the packet issue was in final processing, the Ariane program lost a flight (V18) and the AMSAT Phase 3C launch (V21) has been postponed. There is, as of yet, no new date, and I wouldn't mention it now even if there were.

As of this month, the packet column contains some information at a slightly higher than beginner level. On a scale of 1 to 10, 10 being esoteric ivory-tower stuff, I'll try to keep it in the 3 to 5 region for a while. That's the way my mail has been leaning, and the August issue should have satisfied the very introductory level needs for some time to come. Think of this as the beginner's guide to intermediate packet topics. It's been shown that it is easier learning Morse code if you take it at a reasonable speed to start with. That's what Wayne says, and he's never been wrong before, right? So I'll toss in some "reasonable difficulty" packet topics to help you get your packet IO raised quickly, and you'll have a month to rest up in between. This month's topics are: "Is 2400 baud really twice as fast as 1200?" and some of the issues raised at the June Digital Committee meeting.

Dallas Hamvention

I attended the Dallas Hamvention in May. The Dallas gang always puts on a good show, and this year was no exception. They take the time to do it right, and spend some of the proceeds to fly in the best guest speakers (blush). They have a lot of vendors and a large swap meet.

This year, several packet manufacturing companies were present. A 2400-bps packet-radio modem was demonstrated at this show, although it was not yet available for purchase. The question heard most often was, "Is 2400-bps packet really twice as fast as 1200-bps packet?" The sad but true answer is, "No, not by a long shot."

The reason for that is transceiver turnaround time—and I'll use that as a lead-in to something a few letters have asked me to discuss: TXDELAY and DWAIT. Sit back and I'll tell you all about it.

Packet's Black Hole

In the pre-digital days, no one really cared how long it took between the time the other guy's hand gripped the microphone on one radio and when the words started coming out of the speaker on another radio. As long as no delay was noticeable to the human senses, the process was fast enough. There was no "black hole" turnaround time. Even if the process took a half second or a bit more, the most that would be missed would be part of a syllable. And since there is usually a long interval of time between the hand clench and the unclench, the percentage of syllables lost in any one transmission is vanishingly small. If the radios take 1/2 second to turn on and the total transmission is 60 seconds, the time wasted is 0.83%.

Then came packet, where half a second is time enough for 60 characters to be missed at 1200 baud. If a packet takes .6 seconds to send and the turn-on time is .5 seconds, 45% of the time is wasted. Fortunately, most radios are faster than .5 seconds, but some are not much faster.

In packet, we are very interested in the total turnaround time. A radio has three timing parameters of interest here: the time it takes between when the push-to-talk (PTT) line is asserted and when stable rf is being emitted (key-up time), the time it takes between when the PTT line is released and when the radio is ready to receive again (un-key time), and the time it takes the receiver to lock up and unsquelch (RX start time). For the purposes of this discussion, we'll define turnaround time as un-key time plus receive time.

It is your radio's turnaround time that usually will determine the minimum time that the station you are talking to must wait before it starts to send data. This is because the sum of your un-key and receive time is usually larger than the other station's key-up time. One turnaround-time interval must pass between the end of a frame that you transmit and the start of a frame the other station transmits. This relationship is shown in Fig. 1.

The other station does not have a direct adjustment parameter for your turnaround time; it has only one for its key-up time. This is called TXDELAY. Most hams set a TXDELAY that is far larger than what is actually needed for their own key-up time. This is fortunate; otherwise, many packets would be lost due to the turnaround-time black hole. Note that each station in the local-area net must set a TXDELAY that is long enough to make up for the slowest turnaround-time station in the net. Otherwise, the slow station would have no one to talk to because its receiver would never be ready in time to hear the acknowledgments sent in response to packets it had transmitted.

So far, we've seen one place where time consumed in sending packets is unrelated to the amount of data sent or the speed it is sent at. A second delay is DWAIT. The DWAIT parameter adds additional wait time between when the frequency goes clear and when your station will try to go on the air. There are two reasons DWAIT is used. The first is to leave a hole in the channel utilization so digipeaters can get a word in edgewise. The second is to add delay so that BBS systems won't grab a disproportionate amount of channel time. DWAIT was discussed in detail in the August issue. DWAIT and TXDELAY are shown in Fig. 2.

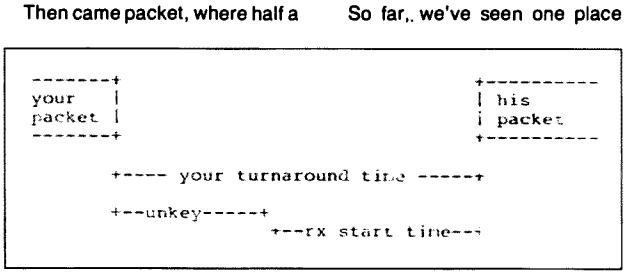


Fig. 1. Turnaround time and packet timing, not to scale.

Figs. 1 and 2 are similar, and, in fact, it is usually the DWAIT parameter at the other station that makes up the extra time that allows your station to get ready to receive another packet. In Fig. 2, the hole left by DWAIT is meant to be filled by the start of a digipeated packet. For best results, DWAIT should be set to the amount of time it takes for the digipeater to key-up—its true TXDELAY value. For BBS stations, DWAIT should be increased.

There are actually a few more complicating factors; one of these days I'll sit down and write a book about it. But for now, this should give you an understanding of some of the non-data speed-related delays in packet.

Is 2400 Twice 1200?

We started this discussion to show why 2400-bps packet is not twice as fast as 1200-bps packet. Armed with the knowledge in the previous section, we can now see why: Data speed is only a part of the total packet time. The effect gained by speeding up the data rate is only proportional to the length of time you are actually sending data. Let's look at the actual time it takes to exchange a packet.

As of the spring of 1986, most of the data on the packet channels comes from store-and-forward message systems. The most popular systems, written by WØRLI and WA7MBL, send out packets based on the length of the line of the message being sent. There seems to be a disagreement on the best number of packets to send out in a single transmission (MAXFRAME); some use one, others two or three. For this discussion, we'll assume that two are sent.

Many stations keep the default

TXDELAY setting of 30. On the TNC-2, this means the length of time to wait for the transmitter to turn on is 300 milliseconds (ms). WB6YMH and I ran a test this afternoon to see how small we could make it. My receiver (an IC-251) has a turnaround time of 220 ms. We determined this by connecting our stations together, and then setting WB6YMH's TXD to 1. I sent a frame, and WB6YMH's TNC station acknowledged it. He increased his TXDELAY until my TNC heard the ack. He had to set TXD to 22 before my station got turned around in time to hear the ack. (By the way, I'd be interested in getting reports on the turnaround time of other radios.)

For the first example, I'll use actual parameters from a local BBS and its user TNCs to show the average improvement to be expected. Assume there are two IC-251s with TXDELAY on a TNC-2 set to 22. The transaction to be measured is two packets containing 72 data characters sent in one transmission, and an ack frame sent in a second transmission. DWAIT is 30 on the BBS, and the default is 16 on the user TNC. Length of a single data frame is 576 data bits plus 152 overhead bits—addresses, CRC (Cyclic Redundancy Check), for examples. The ack frame is 144 bits long. The total data sent is 1,600 bits. The total non-data delay is 900 ms. The total transaction time at 1200 bps is 2.23 seconds; at 2400 bps it is 1.57 seconds. Thus, 2400 bps is an improvement of only 1.4X, or 42%.

You can get closer to twice as fast if you are doing a point-to-point bulk file transfer and if you retune your TNC accordingly. Assume a file transfer, with the file sent four frames at a time, 250 bytes per frame. The other parameters remain the same, and the improvement is 1.8X, or 80%.

Note that even if the data rate is increased to 9600 bps, the improvement is only 2.1X, or 110%. So how do we get faster? By decreasing the turnaround time. In discussions with those who know radios, I'm told that 10-ms turnaround times are easy and that 1 ms is obtainable with a little care. Assuming a 10-ms turnaround in the first example with no data rate increase, the transaction time improves 1.65X, or 65%. Then increasing the data rate to 2400 gets an additional 1.98X improvement.

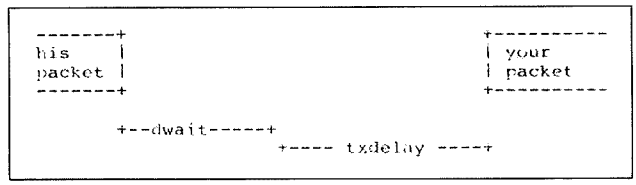


Fig. 2. DWAIT and TXDELAY.

It should now be obvious that what we need are faster *radios*, not just faster modems. There are at least two manufacturers with a project in the works to do just that, i.e., build an rf modem with both a higher data rate and a fast turnaround time. The improvement given by a 9600-baud radio with a 10-ms turnaround time over the 1200-bps, TXDELAY-22 example given above is 11.7X, or more than 1,000%. They may cost more than just adding a TNC to your existing radio, but an 11X improvement is worth the greater cost.

Determining just how much more it's worth will cause the manufacturers some sleepless nights, I'm sure. I saw a prototype of a 4800-baud fast-turnaround rf modem at Dayton, and, as of this writing, hints are being dropped that a 9600-baud rf modem will show up at the San Diego convention in the fall. In the meantime, if you do a lot of point-to-point file transfers, the 80% improvement offered by the current 2400-baud modems in that mode may suit your needs.

An unfortunate side effect of turnaround time and the TXDELAY adjustment is that the turnaround delay of *your* radio should determine the TXDELAY setting of the *other* TNC. There is no standard way of allowing your TNC to suggest a setting to the other TNC. . . yet. Just such a capability came up at the June meeting of the ARRL Ad Hoc Committee on Digital Communications, which is the closest thing we have to an AX.25 standards organization. And that, friends, is the segue into our next topic.

ARRL Digital Committee

Back in my first column, I said the ARRL was doing good things for packet. One is sponsoring and publishing the proceedings of the yearly amateur Networking Conferences, and a second is sponsoring the Digital Committee. This group meets at least twice a year (and has just had its June meeting) to discuss technical issues and to handle various sociopolitical problems that the local League members and offshore Leagues bring up. Officially, the committee is an advisory group to the ARRL board to help the ARRL make decisions on what it wants to do in packet matters. It also has become the semiofficial AX.25 standards committee. Anyone may attend these meetings; one of them each year is held at the Networking Conference.

I'm out of room for this month as it is, so I can only mention a few of the topics discussed. (I'll talk about some of them in detail at a later date.) The major topics were:

•HF frequency utilization. Much concern over the use of HF message-forwarding frequencies and congestion has been expressed to ARRL board members, and they passed it down to us. We gathered information and listed the issues and concerns, and are currently waiting for input from a group of five "Big Gun" HF BBS stations before making final recommendations.

•Automatic operation on HF. The ARRL board executive committee wanted to do a limited test of unattended HF packet with 15 stations participating. The Digital Committee, again consulting the HF BBS community, determined that 15 stations were too few, and is currently working to get the number of stations increased before an official Special Temporary Authority request is filed with the FCC.

•Changes to AX.25. GLB proposed that AX.25 be modified to allow a TNC to poll another TNC to see if any special, manufacturer-specific features are present, and if so to make use of those features. The committee agreed with the desire to add this capability, but disagreed with the proposed implementation strategy. We determined that a new frame called an XID frame would be more suitable. This frame would be sent before the actual connection was begun, and could be used both to request a list of features from a TNC and to state a list of available features. One use to which this capability could be put would be to announce the turnaround time of the station so that the other TNC could adjust its TXDELAY to an optimum value. New features to AX.25 cannot be added lightly; since there are now (as of June) approximately 18,000 AX.25 TNCs in existence, new features must not cause older TNCs to be unusable. Terry Fox WB4JFI is to work up a specific proposal for circulation to TNC software and hardware users and to the general packet-user community.

•Changes to Part 97. The committee has begun work to define major changes to Part 97 to permit future development of digital technology in the amateur bands. We want to have major agreement throughout the digital community before we submit a proposal to the ARRL board to have them petition the FCC. Look for these preliminary proposals in the short-lead-time publications. I'll be discussing why such steps are necessary in a future column.

•Growth. We discussed the Novice Enhancement proposal made by the ARRL, and while everyone had a minor point or two where a change in the proposal was desired, we all agreed that it was a step in the right direction. We agreed that digital was amateur radio's growth mode right now, and if amateur radio itself is to get back on the growth track, digital would be a major participant. We also tentatively agreed to think about proposing to discuss at some future date the possibility of looking into a limited, entry-level digital license that possibly could contain a clause that might be construed as having the attributes of, er, ahem, er, shall we say, a less than complete set of requirements in the traditional telegraphy sense. Seriously, we want to see if it is possible to define a digital license that the general amateur population will accept. This is not a task we've been set to do by the ARRL, and it may never get to the stage where we'll propose it to the ARRL, but since the term "digital license" keeps popping up in various places, it makes sense that the digital community determine what such a thing might be.

We're way out of space for this month. While I've been working on this column, WB6YMH has been using me as a guinea pig for a binary file transfer program that uses the TNC's transparent mode. It looks good, and we may talk about file transfer here next month. Or, we may have something completely different. You'd better check in and see.■

ATV

Number 14 on your Feedback card

Mike Stone WBØQCD
804 Jefferson Avenue
Lowden IA 52255

It is refreshing to see a respected, leading national amateur radio magazine recruiting contributing editors for regular coverage of specialized mode operations. Yes, WAYNE IS INDEED BACK as his *73* ads have been saying. When Editor Perry Donham KW1O asked me to write a monthly amateur television (ATV) column for them, I was flattered and couldn't turn down the chance to preach to a captive audience on just how much fun amateur television can be in the 80s!

Amateur television really got started unofficially way back in the early 30s when experimenters and commercial employees of RCA, NBC, CBS, and other companies ran first tests on the shocking new visual medium and actually did so under their amateur FCC licenses and callsigns. But it wasn't until the 50s that ATV got going on a bona fide hobby basis, and since then it has continued to grow steadily both in interest and in the number of operators. Today, ATV is one of the most exciting modes available in specialized communications and remains an area that encourages building and real experimentation and, of course, is a whole lot of fun!

First a little background on myself. I have been a licensed amateur for about 12 years now and currently hold a General-class ticket. I have been active from time to time on nearly all HF bands on SSB (including 160), but have of late spent most of my time on VHF/HF RTTY or ASCII, fast- and slow-scan TV, facsimile, and more recently VHF/HF packet radio. I am solely responsible and take total blame for shutting down OSCAR 6 (I think WØRWC and I here in Iowa wore out the solar cell batteries). I spent a few years passing traffic and SSTV in the U.S. Navy/Marine Corps MARS (NNNØAWF).

I'm also the current editor/publisher of *The SPEC-COM Journal* (known as *A5 ATV Magazine* until March, 1985), a relatively small specialty communications periodical (strong on ATV modes) published 10 times per year (see our ad in this issue), and I founded The United States ATV Society (an organized group of ATVers) in January, 1983.

It is my hope that I will be able to enlighten you, the reader, on how simple and easy it is to get "on the ATV airwaves" for a minimal investment. I need to hear from you *73* readers and will try to answer as much mail directly as possible. Have patience on replies and always include an SASE. If you are already active on ATV, send me a photo of yourself and your TV station setup and a bit about yourself and the activity going on around you. Some of this material may also be selectively cross-published in *SPEC-COM* from time to time.

To start, I would like to briefly touch on the different types of ATV, how to get started, how to build or purchase gear and antennas, where you can read more about ATV, and just how much it will cost you to get on the air.

What Is ATV?

Let's talk for a moment about the different types of ATV. Most of the public and many thousands of licensed amateurs are NOT aware that licensed ham radio operators (Technician class and above) can operate full transmit and receive TV stations! Fast-scan television (FSTV)—called fast scan mostly to distinguish it from the type of picture sent on slow-scan TV—uses exactly the same standards as American Commercial NTSC TV, i.e., 525 lines of captured amplitude modulation (AM) video information with black and white or color (depending on the type of camera used), accompanied by a 4.5-MHz FM audio subcarrier that produces the sound that comes out of your TV set. This match to the American Television standard makes conversion to amateur television an ideal, low-cost option because any household TV set can be used to receive ATV! "Live" UHF-TV pictures can be transmitted from any camera over the airwaves from one person's shack to another—sometimes over distances of several hundred miles. VCRs have become quite a popular tool for storing and recording FSTV programming and CQ calling and testing sequences.

Slow-scan TV is the still-frame, slide-show type of image that you have perhaps seen coming from the Voyager spacecraft vehicles where the picture starts painting from the top of the screen and downward in a slow, but steady display pattern. Slow-scan TV signals are really video pictures converted into audio tones sent through your radio's microphone circuit, picked up by the other person's receiver and decoding box, and reconverted into a video picture on the tube again. Since the tones sent and received are in audio form, they can be recorded on any standard audio cassette or reel-type recorder for later replays. The old days of green or yellow P7 image-storing tubes and blurry, fading pictures are long gone and have been replaced by quality, high-resolution b/w or full color images.

Unlike fast-scan TV, which is limited to local area ground-wave propagation, SSTV can travel thousands of miles—from California to South Africa and back again—on the HF bands, all in just a few seconds of transmission time! (A General license and above is required at this time.) 14.230 MHz on the 20-meter band and 28.680 MHz on the 10-meter band are the two most used "hot spots" for this type of activity.

Tune in on your HF receiver at just about any time of day or night and listen for the operators



Photo A. Hi, from Mike WBØQCD.



Photo B. Dave Guthrie (formerly 5NØDOG) operating RTTY/SSB/SSTV from Lagos, Nigeria, in March, 1980.

talking about their video pictures and SSTV gear. Most SSTV operators will stay in one small frequency area of operation so their shrill tones won't annoy others nearby not interested in the fascinating TV picture mode. A good time to catch these fellas and gals is on a Saturday, late in the morning and in the early afternoon (1800 UTC) on 14.230 MHz as they check into established SSTV nets conducted by Brooks Kendall W1JKF and Don Miller W9NTP. They have a lot of fun "relaying" each other's pictures from one part of the country to the other for all to see!

One other form of ATV that is gaining popularity is similar in standards to SSTV, but is usually classed in a separate category. I am speaking now of facsimile TV. FAX for many years was a paper-printing picture and information mode only. But now, with today's technology, it, too, has worked its way into small IC chips and color video monitors.

While all three forms of ATV have been crossed in transmissions, FSTV and SSTV are generally thought of as true ATV. The slower, but more interesting FAX mode of visual communications is now being covered in Dr. Ralph E. Taggart WB8DQT's column, WEATHERSAT, beginning with this issue. Any mention of the FAX mode in MY future columns will be of a very limited basis. Check out Ralph's column for the latest in what's happening on that medium.

Which Mode Should I Get Into?

Which type of ATV is right for you? Maybe you would like to try them all but want to take on only one at a time. Perhaps asking yourself a few basic questions about your current interests might help to steer you in the right direction. Do you have patience and do you like to tinker, solder, build, experiment, and operate the VHF/UHF bands more than the HF frequencies? Do you already have a video tape recorder and a camera of some type, or do you really enjoy the challenge that UHF operation demands? Then fast-scan TV is for you.

If you like to work DX, work all states, conduct long, general ragchews, and have a better than average hobby spendable income, then slow-scan TV will be quite enjoyable for you. Both ATV modes can be done cheaply or expensively. I will steer you and give you the choice of both directions in my future columns. For this month's column, I will briefly discuss getting started in fast-scan TV, as it is the newest and most misunderstood mode to most radio amateurs.

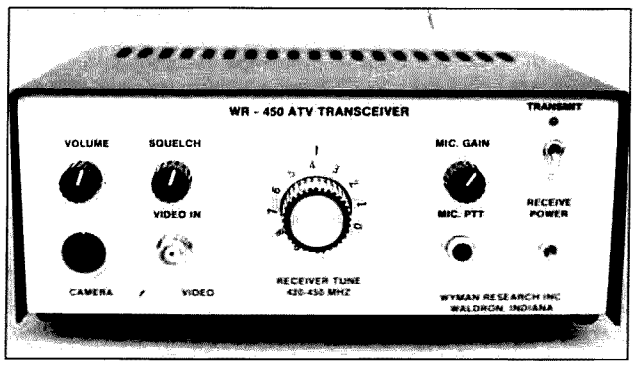


Photo C. Wyman Reseach WR-450 ATV transceiver.

And Now a Brief Word From Our Sponsor

If you are serious about getting started on FSTV, I recommend *SPEC-COM*'s ATV manual, *EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT ATV *but were afraid to ask*. It is 112 pages and 15 chapters of jam-packed information from the history of television to ATV repeaters, groups, and clubs in the United States. This manual has a lot of money- and time-saving tips, construction diagrams, projects, article references, and commercial advertising that will answer a lot of your questions about ATV. Even SSTVers should have this book. It sells for $9.95 ppd. Write for Book #100 to the address at the end of the next paragraph.

While I have the store open, any of you who would like to receive a "free" sample issue of *SPEC-COM*, just send $1 to help offset the postage and I will put a recent issue in the mail to you along with subscription information (see our ad in this issue). Order the above book, and I'll include the issue in the same envelope and pay the postage for you (you must ask for the sample issue to be included). Both items are published and available from The SPEC-COM Communications Group, PO Box H-73, Lowden IA 52255. End of commercial.

Back To Our Movie

The biggest problem in getting on fast-scan TV is finding someone else to see your pictures. Maybe you are lucky and you already live in or near an area that has ATV going. Most major cities in the United States have some level of UHF ATV activity. Drop me a line with your location, and I will give you the names and callsigns of amateurs around you already operating the mode, what antenna polarization they are operating, and what frequencies they are sending their pictures and talking on. If you are in an area where no ATV activity exists, you have the distinction of becoming a real pioneer! For that, you'll need a buddy to get on the air with. 439.25 MHz is the nationally recognized calling frequency for FSTV operation.

To get started using ATV, you need a small UHF TV-type antenna, some good low-loss coaxial cable, a downconverter, and a good working (preferably state-of-the-art) TV set. That's it! To send ATV pictures and sound, you simply add a transmitter, a microphone, and sound subcarrier generator. A complete low-power ATV transceiver can be purchased "ready to go" for less than $300. If you would like to build it yourself, you can save even more money!

There are several companies here in the United States making quality, low-cost, commercial-type ATV transmitters, receivers, and related equipment. The largest and oldest by far is one owned by Tom W6ORG and Mary Ann O'Hara WB6YSS. Their company is called P.C. Electronics (2522 S. Paxson Lane, Arcadia CA 91006; (818)-447-4565), and they, too, have regular ads in *73*. The basic ATV "receive only" downconverter board that is completely tuned and built (ready for cabinet housing) costs $49 (TVC-2). An 80-mW transmitter runs $89 delivered (a 10-Watt version is $179). A complete 1-Watt PEP "all-featured" FSTV transceiver is offered for $299 (TC-70-1).

In the Midwest, Don W9NTP and Sue Miller W9YL of Wyman Reserach (RR#1 Box 95, Waldron IN 46182; (317)-525-6452) offer similar equipment. Send an SASE for their catalogs. Wyman's line "gives you a choice" and lets you build an ATV rig from scratch with a bare board, supplied parts, and extensive documentation at even greater savings.

Communication Concepts, Inc., (2648 North Aragon Avenue, Dayton OH 45420) has a neat little ATV-1 receive board kit for $34.95. Want to buy your own parts? The board is available for $10, the manual for $5.

TV sets can also be modified to receive channel 13-1/2 ATV signals and, when preamped, can be as sensitive as purchased or built downconverters. Since the TV set is the receiver, most of the expense has been taken out of getting on the visual mode. A lot of ATVers like to home-brew their own small UHF TV antennas, and they work just dandy. KLM and the more popular English-made Jaybeams are used by most for the best performance, especially over long distances. P.C. is a good source for the KLM antennas and John Beanland G3BVU/W1 of Spectrum International (PO Box 1084SC, Concord MA 01742) is the U.S. distributor for Jaybeams.

Good low-loss coaxial cable is essential, such as Saxson's 8285, Belden's 8214, or preferably their better 9913 line. High-power amplifiers of 50, 100, or more Watts can be purchased from Mirage and other sources or home built to extend the operating range of your fast-scan TV signals. It is not uncommon here in the Midwest to work distances of more than 250–500 miles several times in the year during band enhancements. During Field Day weekend, from Iowa, I made two 2-ways with P2 pictures with stations in Cincinnati, Ohio!

Well, gang, I have tried to give you a fast crash course on what ATV is, how to get started, and where to begin to find sources for equipment. Later, I'll go more deeply into the specifics of these modes and how they are being used on the air today, along with a list of ATV groups and repeater systems around the country. Stick with me and *73*, and I will soon have you doing the "nightly news" from your anchor desk. Goodnight, Walter.■

QRP

Number 24 on your Feedback card

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

I guess that I should get several things out in the open. Number one, I don't want anyone to think that I'm out to lower the power limit on the amateur bands. I like the idea of telling a newcomer in my shack that I can run up to 1.5 kilowatts PEP output. When I try to explain to that new Novice that he can work the world on a "Watt or two," he looks at me as if I'm not wrapped too tight.

If you enjoy running an amplifier, hey, that's fine with me! In fact, if it were not for the QRO (high-power guys) on the other end, life would be very dull for me. There are times when "the other guy's" skill, patience, and expertise make all the difference in making the low-powered QSO work. If that still makes you upset, then I guess you can join the "Hate Mike Bryce Club." Send all requests to my wife, Lynnette, president of the club, or to vice-president Terry Russ N8ATZ. It should be noted that Terry is under a six-month suspension for buying me a Coke at a hamfest. I run QRP because I *like* to, not because I must.

I imagine there are several different types of people who will read this column. Number one would be those interested in QRP operation. Second, those who heard about it and would like more dope on the subject. Third, the guy who's curious about different hobbies within amateur radio. And finally, the guy who grabs this issue on the way to the men's room. I hope to include something for everyone.

QRP

I'm not one to break tradition, so we might as well start at the beginning. Just what is this QRP stuff anyway? I'm sure you have all heard about it before, but may not know exactly what it's all about. Well, operating QRP means running low power. So the first question is: "How much power is QRP anyway?" That's like my three-year-old son asking, "How high is up?" The answer to both questions depends on whom you talk to or what you read.

The international Q signal shows QRP as "decrease power," but does not say decrease to what. Placing a "?" after the Q signal asks the question, "Shall I decrease power?" I doubt that very many of us hear that one on the air! The FCC has a regulation on the books, Part 97.67, that goes like this: "Notwithstanding the provisions of paragraph (a) of this section, amateur stations shall use the minimum amount of transmitter power necessary to carry out the desired communications."

Hmmm, sounds kind of open to me. In real life it's not followed too much. As an example, let's say you're running a kilowatt on 20-meter SSB. If you reduce your power to 400 Watts and still are S9 on the other end, you can say you're QRP. I don't think 400 Watts is QRP, do you? But what if you're running 10 Watts and are S9—you're still illegal until you reduce power to, say, 2 Watts. So the answer to the question? Well, the term QRP is relative. I would be QRO at 20 Watts if you're running 5 Watts, and you'll be QRO to someone running 900 mW.

"If you're running 10 Watts and are S9 you're still illegal until you reduce power to, say, 2 Watts."

Even the ARRL is gray in this area. For example, the League defines QRP as 10 Watts input, 5 Watts output, but does not recognize power levels under 1 Watt as being very, very low power. (In some circles, it's known as QRPp; to others, milliwatting.) As for me, I consider anything under 5 Watts *output* as QRP—no matter what the input power is. This is also the power limit defined by the QRP ARCI (more about them in a later column).

I hope that brings a better understanding to you about QRP power levels. Now if you're up to it, give low-power operation a try. Every radio ever made, home-brew or store-bought, can be used on QRP. Every one that I have ever seen had either a drive-level control or an rf-out level adjustment. By placing an in-line wattmeter between the antennna and the transmitter and by reducing the drive or rf level, you can put the output power anywhere you want. If this is your first attempt, try running about 20 or so Watts output. This will ensure a good number of contacts and start your blood moving. Keep reducing your rf power to 2 or 3 Watts, and then start enjoying the true sport of QRP!

After a while, you may notice it does not make much sense to run a 100-Watt radio throttled down to 2 Watts. There are what I guess you can call QRP transceivers on the market. Without a doubt, Ten-Tec's famous "Argonaut" series transceivers are world-class. The Argonaut's big brother, the Argosy, sports a low-power position switch for power output of less than 5 Watts. Hardly a red-blooded QRPer has ever been born who has not at least operated one of these radios. Ten-Tec also sold the Century 21, a high-powered QRP transceiver if you will. The Century runs about 35 Watts output, and can be reduced in output via a front-panel control. The Century 21 was discontinued a few years ago, and the Century 22 took its place. It also runs about 30 Watts output and sports a variable rf drive control.

Next in line comes the Heath HW series. Heath sold about 10,000 HW-7s and somewhere in the neighborhood of 15,000 HW-8s before they were taken off the market. Heath's new HW-9 is selling very well. While the HW-7 was a bit of a dog, the HW-8 remains a very strong QRP contender. There are many other makers of transmitters/receivers and transceivers. Some are now history, and others are very new to the marketplace.

There is one more way to get on the air without the need of lighting off that big rig. You can try your hand at building a transmitter of your own. There are some very simple one- or two-transistor transmitters out there, but I would recommend that you first get your feet wet by working a few stations with the QRO transceiver at reduced power. There have been reams of paper consumed describing different transmitters to build. You will never know the satisfaction of making contacts with something you have built with your own hands until you try. It's not that hard, and it's a lot of fun!

No matter what amount of power you're used to running, the antenna makes the difference between an empty log book and a mailbox full of QSL cards. Even more than ever, a good antenna system is a must. It pays to use the best. Put a good dipole up high and in the clear. Use some type of gain antenna on 20, 15, and 10 meters. Monitor the propagation. Use the propagation as a tool. Listen to the bands. If someone is running a kW on 40 meters in Ohio and he is only S3, with you in New York, then you may as well go watch reruns of "Star Trek" as to try QRP that night.

If you have yourself all geared-up and ready to go, where do you look to find some good QRP action? Depends on the bands, but listen for low-power stations on 80 meters at 3.560 and 3.540 MHz. On 40 meters at 7.040, 7.030, and 7.060 MHz. On 20 meters at 14.060 MHz. On 15 meters at 21.060 MHz. And finally on 10 meters at 28.060 MHz. What's this, you're not into CW? Then try SSB on 80 meters at 3.985 MHz, 40 meters at 7.285 MHz, 20 meters at 14.285 MHz, 15 meters at 21.385 MHz, and 10 meters at 28.885 MHz.

On the Hook

Next time, who knows? Perhaps some contesting with low power. If you like the column, then please tear out the Feedback card and send it in. Wayne Green reads these columns at night, so I hope that he gets to mine before his warm milk and cookies. I know he would like to hear from you about how I'm doing. And secondly, I need the money! So drop the 22 cents for a good cause. I would also like to hear from you, the readers, about what you would like to see, or not to see, here in the QRP column. I have a big mailbox and a friendly mailman (mailperson?), so drop me a card or letter, and we'll see what happens.■

RTTY LOOP

Number 26 on your Feedback card

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

NEITHER SNOW, NOR RAIN. . .

The column this month is dedicated to our local letter carrier, who is recovering from injuries suffered while bringing me the last (heavy) bag of fan mail. I shall try to wade through as much of this as I can this month.

John Gunsett KI4VP of Manassas, Virginia, asks whatever happened to Macrotronics, Inc., of Turlock, California, which manufactured the Terminall unit. He has upgraded his computer setup from a TRS-80 Model I to a Model 4 in the Model III mode, and would like to upgrade the Terminall unit as well. Well, John, I have no information on that company. The only thing in the files for the TRS-80 Model I/III/4 is a program written by Clifton J. Turner, Jr. WB5KCQ in Alexandria, Louisiana, which several amateurs have found comprehensive. Does anyone out there know about Macrotronics? Let me know, and I will pass along the information to the masses.

Greetings to Robert Davis, of Gillette, Wyoming, another of our loyal readers. I hope the information sent out is of use. Kenji Sugimoto JG1GWL/KE6QX in Setagaya, Tokyo, Japan, also sends along his regards. I hope to hear you on RTTY soon, too, Ken. Ditto to Gary Allen, of Mt. Carmel, Tennessee, and Nathan Leichty, of Grand Rapids, Michigan.

Serge Cuvilly HH2C of Port Au Prince, Haiti, would like to interface a recently purchased HAL DS-3000 KSR terminal with an Epson RX-80 printer for a hard copy. Well, Serge, I do not have any information on the DS-3000, but if it has an RS-232 modem connector as does the DS-3100, you may be able to use that serial output to feed the printer, assuming your printer has a serial interface. Anyone out there done this one yet? Let me know, and I'll print what I can find out to help us all.

All of the comments about stray rf, going one way or another within the ham shack, prompted a response from J. Fred Bergsma VE3CLS of Stratford, Ontario. Fred relates that, rather than having problems with rf in the shack exciting his computer, he seems to have more problems with rf from the computer bothering the HF and VHF equipment. The VHF antenna, he states, is in close proximity to the computer, which accounts for a large part of the interference—although he believes that a more typical installation might still be affected.

Fred lives in an apartment, and is having his share of problems installing a good ground system. Nonetheless, he feels that his computer, an IBM PC, would make a good RTTY station, if only he could solve this one problem.

Well, Fred, if you are able to obtain enough of a ground for the ham station to work, I doubt if that is the source of the problem. Having the VHF antenna near the computer certainly may be a problem, though, as radiated rf, originating in the computer, may be picked up by the antenna, partially rectified (detected) by the VHF radio, and re-radiated to create spurious signals all over the spectrum.

Depending on just what kind of computer you are running—IBM brand, other brand, or brandless clone—shielding within the computer cabinet may be adequate, borderline, or nonexistent—not necessarily in that order! If you can shield the box and any cables running outside of the main unit, this may help as well. Keep plugging along, and let me know how things interface.

Speaking of interfacing (sorry), Gary G. Flechtner WB8HLI of Tiffin, Ohio, has a Commodore Plus/4 computer that he would like to put onto RTTY. He states that his queries to several Commodore Users Groups, as well as inquiries to other magazines, have been fruitless. Surely one of our readership must have a solution for Gary's problem, no? Drop me a line, and I will print the information for all to benefit!

Russ Butterworth WA6TJS of Corona del Mar, California, has just acquired an Apple //c, with an added CP/M card, and all the accessories, and would like to get onto amateur RTTY, as well as receive weather and news on CW, receive and possibly send TELEX via European commercial stations, and get onto packet radio. He wonders just what is needed to accomplish at least all of this.

Well, to begin with, amateur RTTY is easy. Just use any of the RTTY programs we have covered here in the past. Well, kind of easy. You see, most, if not all, of these have been directed at the Apple][or Apple //e computers. A few months ago we dealt with the difficulties of interfacing the Apple //c on RTTY given its apparent lack of game ports or the like. I have received no answers on this one, and this reported difficulty may influence the rest of your task.

So, while there have been many programs published to run CW on Apples of various species, I am at a loss for interfacing the //c at this point in time. Packet is not so much of a problem, however, as this normally requires an ASCII terminal program of sorts, with an external terminal node controller, which itself contains most of the "smarts." I hope more will be available for the Apple //c, and don't doubt that it will. As it becomes available, where else do you think you will see it, but right here?

Up in Winchester, Massachusetts, Bob Thompson N1CIH is trying to put his TRS-80 Model I onto RTTY. Among other things, he has looked in vain for the function generator detailed here a few months back in the "single-chip RTTY" circuits. Well, Bob, although Radio Shack has omitted these chips from their current catalog, a look around at a few other parts suppliers (they advertise widely) will turn up the XR-2206 and other chips to boot. You may even find them on the wall of a local parts emporium, safely encased in plastic bubbles.

The information presented on the Model 100 touched a responsive chord in Lou Graue K8TT of Bowling Green, Ohio. Lou has written several RTTY programs, and offers a possible solution to the Label Line question on the Model 100 program.

Adding the following line to the program will label the keys:

```
176 KEY1,"60WM":KEY2,
"66WM":KEY3,"75WM":KEY4,"
100":KEY5,"T - R":KEY6,"
NL":KEY7,"LPRT"
```

In order to return to default, line 300 should be changed to read:

```
300 CALL 23164,0,23366:CALL
27795:MENU
```

And, if you want the label line to come up at the beginning, add the line:

```
177 CALL 17064
```

Lou adds that you cannot toggle the label line while in "receive" but you can while in "transmit." Thanks for the help, Lou. I am sure that the many Model 100 users thank you as well.

Can anyone help Agust Bjarnason TF3OM from Iceland? He is only one of many users of Macintosh computers that yearn for the thrills only RTTY can deliver. So far, none of my feelers for a MacRTTY program have been answered. I somehow can't believe that at least a couple of dozen hams aren't running a Mac on RTTY—am I that misguided?

Yes, that fabled list of reprints is still around, and remains available for a little old self-addressed, stamped envelope. For those of you who may have come in late, this list is a recap and revision of some of the material in earlier years of this column. Feel free to ask for the list; you just may see something that interests you.

I continue to hang out on several national BBSs, as well, as time and expense permit. E-mail addressed to user number 75036,2501 on CompuServe or to MARCWA3AJR on Delphi stands a better than even chance of reaching me. I try to reply to E-mail as soon as possible after I receive it; certainly faster than written mail. After all, I am already at the terminal when I receive it! Anyway, letters are, of course, welcome. Enclose that self-addressed, stamped envelope with those letter questions if you desire a personal response, as well.

And now, a tease. For several months, I have been hearing from owners of TRS-80 Color Computers that what they are looking for is a disk-based RTTY program, with full features. As I write this last paragraph, guess what just showed up here at the station? Let me look this over and play with it for awhile. The result should hold a great big find for CoCoNuts in a future column. Don't worry, I won't forget the rest of you. How could I? You tell me that *73*'s most read pages are right here—in RTTY Loop!■

LOOKING WEST

Number 19 on your Feedback card

Bill Pasternak WA6ITF
28197 Robin Avenue
Saugus CA 91350

DON'T TELL A MAN NOT TO DREAM

If Milt Jensen N5IA had not believed that dreams could be made into reality, the Zia Connection would never have been born. What is the Zia Connection, you ask? It's many things.

Technically speaking, it is simply a bunch of repeaters that have been interconnected to let hams in one town talk to hams in another and to those on the road in between. Obviously, there are some who look at the Zia Connection as a marvel of modern technology. It can be seen as proof that open, wide-area, intercommunity repeater linking on a full-time basis can be accomplished even over long distances. Most important, though, it proves that amateurs involved in VHF FM need not be shackled in their communications abilities by the designated coverage of their favorite repeater: Through cooperative effort it is possible, as the telephone company has said for years, to reach out and touch someone. The Zia Connection is all this and a lot more.

For those of you who have not guessed by now, the Zia Connection is a wide-area, open, interconnected repeater network. To be more specific, it covers an area that stretches a shade under 1,000 miles across the southwestern United States. The actual east-to-west distance is about 600 miles, but that does not count some of the north-south tributaries that have been built into the system to serve communities like Tucson, Arizona; Albuquerque, New Mexico; and El Paso, Texas. To say that the Zia Connection is the world's largest open repeater is not to make an overstatement. One must either use the system or view a map of it to understand its vastness. In a magazine we can bring you the latter: See Fig. 1.

Unlike other linking systems that limit access to a select few or that stringently control overall utilization, the Zia Connection is a totally open, interconnected system available to any licensed amateur wishing to use it, on a 24-hour-a-day basis. The only times that portions of the system are not available to all users are when technical difficulties arise or when some local disaster situation takes precedence. Thankfully, these instances are few and far between.

Using the system is no different from using any system. It operates in full-duplex mode, which means that signals go both ways over the link at the same time, not unlike a conventional telephone. Operationally, this is very desirable as it allows instant break-in. It also prevents doubling with another station when users have the capability to operate their own stations in the full-duplex mode, as well. In most cases this means having a pair of radios on separate antennas—one talking on a Zia Connection repeater input and the other on that system's output. Full duplex is not necessary, but it does tend to make operating sessions very pleasant for those using the system.

According to N5IA, working stations through the Zia Connection is no different from working them through a single repeater. Each repeater in the system has its own timeout setting, but all repeaters are matched as closely as possible. This way if you time out one of the local ports, you do not cause the entire interconnected system to crash. It remains up and running; only you go away until the timer reset occurs. This is accomplished by not timing the link transmitters to the local repeaters or vice versa.

The only identifier heard when using the Zia Connection is that of the local repeater port. The automatic IDs of the link transmitters are notched out and not repeated on the talk-around or talk-back. When you drop your carrier after a transmission, most ports will "Courtesy Beep Tone" after about a one-second delay. This is a reminder to allow time for other stations to break in, as they would on a local-area system.

The drop-out time from one end of the system to the other is in the order of 200 milliseconds, so it is almost impossible to tell which repeater is inputting to the system. Unlike other interconnected repeater systems, you will never hear a series of squelch tails after you unkey. The same is true on key-up. The pickup time is about 300 milliseconds for the overall system, and Milt suggests that you make it a habit to wait for about a half-second after keying your transmitter before you start talking.

Most of the repeaters within the Zia Connection (see list in Table 1) are privately owned and funded. It is a tribute to the small group of people who dreamed it up that a system of this magnitude has developed a wide enough following to exist with purely voluntary support. Obviously, the setup initially involved a tremendous outlay of capital, and thereafter its operation involved considerable expense (site rental fees, power, equipment maintenance) and effort—laborious trips up the sides

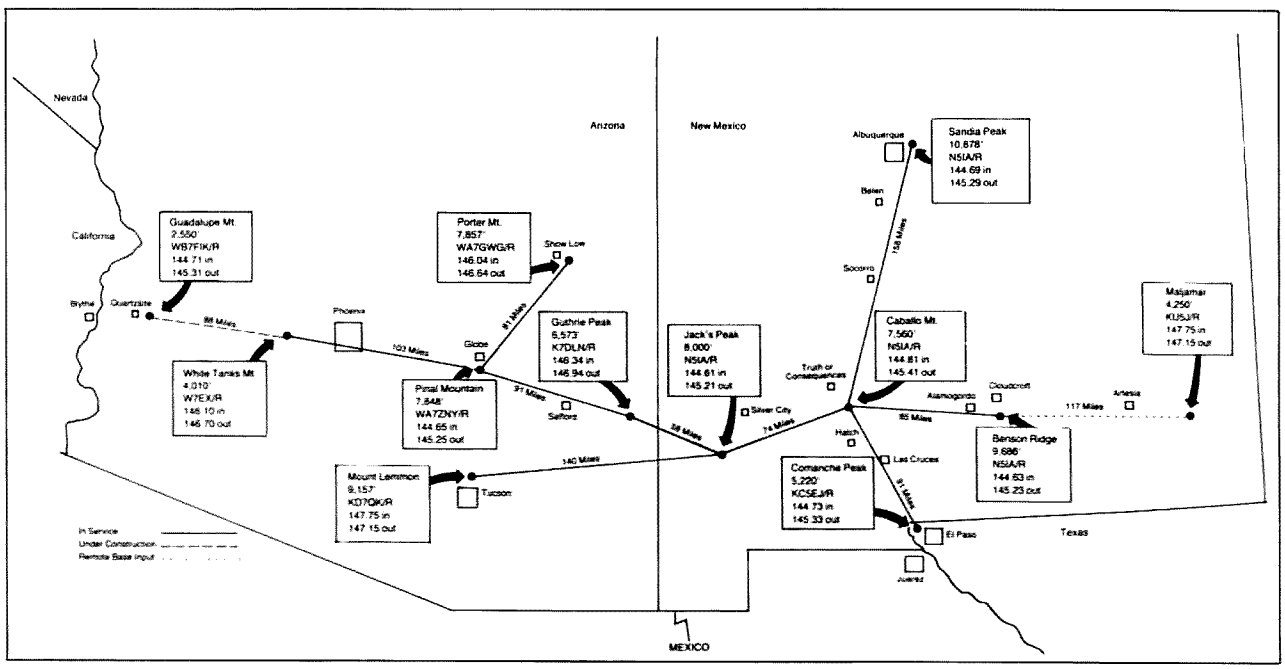


Fig. 1. The Zia Connection repeater system.

of multi-kilofoot mountains, for example.

It exists because it provides a service that nothing else could, not even a 75-meter SSB point-to-point system. The Zia Connection is a living monument to the greatness that we amateurs can achieve. Amateurs involved in VHF FM repeater operations need not have their entire world revolve around the 50-mile radius of a local repeater. Rather, horizons can be expanded: With a simple $200 HT, you can communicate a good part of the way across the continent.

For more information about the Zia Connection, send an SASE to Milt Jensen N5IA, Rte. 1 Box 156, Duncan AZ 85534.

Site	Equipment Owner	On Line
Mt. Lemmon	John Vanza AK7Z	8/82
Pinal Peak	George Lewis W7SBZ and Joe Montierth WA7ZNY	3/86
Porter Mt.	Kachina Radio Club	5/85
White Tanks Mt.	Ken Simpson WB7DRD	10/83
Guadalupe Mt.	Milt Jensen N5IA and Cactus Radio Club	–
Jack's Peak	Milt Jensen N5IA	7/82
Caballo Mt.		1/83
Benson Ridge		9/82
Sandia Peak		5/85
Comanche Peak	Rick Fultz KC5EJ	12/83
Guthrie Peak	Eastern Arizona ARS	8/82
Maljamar	Bob Perkins KU5J	9/84

Table 1. Who owns what and where.

The Super Councils Are Coming, the Super Councils Are Coming

Do the names Mid-America Repeater Council, Southeastern Repeater Association, or Tri-State Amateur Repeater Council mean anything to you? If you are involved in repeater frequency coordination, they may. But if you are just an average Joe Ham, these names probably mean very little. You should know about them anyway, because their very existence can and will eventually have an effect on your day-to-day, on-the-air operation. You see, these are the first three "Repeater Super Councils." They are voluntary coordination groups that have stepped beyond the boundaries of a given state or local area to become recognized regional leaders. In my view, they are the vanguard of things to come.

By far the largest and most successful of the Super Councils is the CVRA-SERA (the Carolina Virginia Repeater Association-South Eastern Repeater Association). Started 15 years ago to handle the emerging repeater coordination needs of the states of North Carolina, South Carolina, and Virginia, the organization never had any intention of expanding. However, as time progressed, amateurs in adjoining states watched the way the CVRA-SERA handled coordination, emphasizing technical excellence rather than politics. Pleased with what they saw, one after another of the neighboring states petitioned CVRA-SERA for membership. As a result, today the SERA oversees coordination of more than 1,200 repeaters in seven states. They do this through autonomously elected Area Directors and Area Vice Directors, who represent the will of the majority of a given state.

The SERA itself serves mainly as an umbrella organization, setting technical standards and band plans, settling inter-area disputes, and publishing what I can only consider the very best of newsletters put out by a repeater council. Did I say "newsletter"? Magazine would be a better term, since four times a year that's exactly what the SERA mails out to its members and other interested parties. Their May, 1986, issue was 50 pages and semi-hard-covered. Topics included lightning protection, the possible effect Novice enhancement will have on repeater operation, and a lot of information on the happenings within the organization itself. It also has paid advertising from some of the top names in the amateur supply industry, as well as numerous major amateur conventions. It's a magazine that rivals the "big four" in both quality and appearance. Not bad for what amounts to a small group of volunteers. In fact, the CVRA-SERA is doing such a good job that they now have become the standard of excellence to emulate.

In addition to the Carolinas and Virginia, the organization also oversees coordination matters in West Virginia, Kentucky, Georgia, and Tennessee. Alabama has petitioned the CVRA-SERA to become its 8th district. Not wanting to be accused of plundering the domain of another regional coordination group, however, the CVRA-SERA has wisely placed that application on hold until the political climate in Alabama is more favorable. With tempers flaring between pro-15-kHz and pro-20-kHz factions, the CVRA-SERA does not feel it should get involved in the political unrest of that area. They can only be successful if they have 100% support, and right now that is impossible in Alabama.

Another coordinating group that had no intention of ever becoming a Super Council is TSARC, the Tri-State Repeater Council in the Northeast. They came into being a few years after the old Northeast Repeater Association died, and took on the task of bringing order onto 2 meters. This task was accomplished in the late 70s under very able leadership. It wasn't easy since several years had elapsed between the time that NERA went bye-bye and when TSARC appeared.

In the early 80s, with Steve Mendelsohn WA2DHF (now ARRL Hudson Division Vice Director) at their helm, TSARC turned its attention to developing other bands and providing protected spectrum for emerging modes including packet radio. In fact, they were among the first to recognize that packet might well be the boom of the 80s and 90s, as FM repeaters had been the boom of the late 60s and 70s.

TSARC was also the first repeater council to recognize that continued viability in repeater operation meant that rules were needed to ensure orderly growth. The repeater deregulation of the mid-70s had brought with it a wild and uncontrolled expansion in the number of systems coming onto the air, many of which served no other purpose than the owner's ego fulfillment. The result of TSARC's interest in solving the uncontrolled growth problem manifested itself in their supplying much of the input utilized by the FCC in its formulation of the proposals contained in P.R. Docket 85-22, also known as the Repeater Rules Rewrite of 1985–1986. (See the July, 1986, Looking West for more details on this regulatory change.)

While the CVRA-SERA has become a Super Council for reasons of geographic representation, TSARC has attained this position based on its abilities in the political arena. They had some minor geographic expansion when the northern tier of Connecticut decided to break away from having their coordination handled by the New England Spectrum Management Association, and opted for TSARC.

Currently, TSARC represents almost 1,000 repeaters operating in the southern portion of New York state, including New York City and Long Island, plus all of New Jersey and Connecticut. Like the CVRA-SERA, they have no eye toward expanding their sphere of influence past these borders, but as with CVRA-SERA, the Tri-State organization is more than willing to lend its expertise to its neighbors if they seek assistance.

Making Use of Repeaters

Our final story this month is about the way FM and repeaters can be used in time of emergency. It's a hard-news story, so I am going to abruptly change my writing style to that used by the Associated Press and United Press International. It's also the "style" used in my *Westlink Report* newsletter, which is where I gleaned this story from.

Amateur radio proved to be the key element in coordinating a five-day firefighting effort and the largest mass evacuation in the history of the United States. This occurred after a freight train derailed near the city of Miamisburg, Ohio, on Tuesday evening, July 8. Miamisburg is located about 25 miles south of Dayton, Ohio, and is the home of the famed former amateur-radio equipment manufacturer, R. L. Drake. The derailment caused a tanker car filled with white phosphorus to rupture. The phosphorus ignited when it came into contact with air, and the ensuing fire formed a toxic cloud that engulfed Miamisburg and an area about 40 miles in circumference.

According to Area District Emergency Coordinator Ron Moorfield W8ICL, amateur radio was called upon to provide common communications channels to all emergency services coming in-

to the area. As has been the case in other incidents in other areas, in Miamisburg, when police and fire crews arrived from other cities, they were not equipped with radio gear capable of communicating on the frequencies assigned to the emergency services in the Miamisburg area. As soon as it was realized that only amateur radio could quickly provide a common radio communications link with Central Dispatch, some 250 area hams were contacted and pressed into service as emergency-service communicators under the area ARES plan.

Working in around-the-clock shifts, amateurs equipped with 2-meter VHF-FM mobile and handheld gear were assigned to ride in all police cruisers and maintain contact to a station at the Miamisburg Central Dispatch office. Other amateurs were stationed at local hospitals and command posts and were assigned to various officials, including Ohio Governor Celleste. In addition, amateurs funneled information between the local weather bureau and the Environmental Protection Agency, which required weather updates every 15 minutes.

Most communication took place using the MOUND Amateur Radio Club's repeaters operating on 147.195 MHz and 145.33 MHz. In addition, a direct link between the on-site Emergency Command Post and the state's Disaster Service Agency in Columbus was established on 145.11 MHz, with amateurs posted at both ends to handle a constant flow of emergency-related traffic.

Moorefield said that due credit should be given to the MOUND Amateur Radio Club, as well as to hams representing approximately 20 different radio clubs that took part in this emergency communications activity. Some operators came from as far away as Cincinnati and Columbus. At any given time, between 90 and 100 hams were on duty, running shifts from 7 to 10 hours, depending on a given activity.

At the height of the crisis on Wednesday evening, the amateurs assisted the police and emergency-service personnel in the evacuation of 50,000 people from the cities of Miamisburg, West Carrollton, Marine City, and sections of Jefferson Township, after it was determined that the toxic smoke from the fire was a definite hazard to public health. About 15,000 of the evacuees were cared for by the Red Cross at evacuation centers, and again it was amateur radio that provided communications between Red Cross headquarters and the shelters.

The fire was finally brought under control early on Saturday, July 10. "We have a lot of tired amateurs," Moorefield told *Westlink Report*, "but they did a fabulous job. They were there on duty, and I can't tell you the praise I have for the cooperation we had between all the amateur radio clubs."

Moorefield noted that in addition to the normal emergency-service communications channels and amateur radio, the only other type of communication was the use of several cellular telephones by the Environmental Protection Agency. Not in evidence, at least to Moorefield, were any 11-meter CB, REACT, or GMRS-equipped groups. This was one of those very rare times when amateur radio was more than just the conveyor of messages. Our service, its members, and the repeaters that they built became a very important part of a gigantic public-service humanitarian effort.

And that's quite a lot for this month from those of us who write the late shift here in Los Angeles.■

WEATHERSAT

Number 29 on your Feedback card

Dr. Ralph E. Taggart WB8DOT
602 S. Jefferson
Mason MI 48854

Welcome to WEATHERSAT, one of *73*'s newest columns, devoted entirely to the subject of weather satellite activities. Most of you are aware of those high-tech "eyes in the sky," if only through the medium of your evening news. What most people are not aware of is the extent of the contribution of "amateurs"—the condescending title initially tagged on experimenters by the professional satellite establishment—in developing low-cost options for the reception and display of weather satellite images!

When the first weather satellites arced into orbit in the early 60s, a weather satellite ground station was an expensive operation that required significant government input. If you had suggested at that time that any school classroom or individual hobbyist could put together an effective station for about the cost of a color TV set, the "experts" would have laughed you all the way to the mental hospital. What they didn't appreciate, of course, was the drive and ingenuity of a host of people with an interest in weather, electronics, or simply the desire to see the Earth from "out there."

Operational weather satellite programs were hardly "off the ground" when Anderson, in a classic article in a 1965 issue of *QST*, showed anyone who was interested how to put together a workable receiver and picture display system. That article launched the "amateur" weather satellite movement and, as years went by and the satellites became more sophisticated, amateur experimentation continued, using the steady advances in electronic technology to more than keep pace with the satellite systems themselves. The result is that there are thousands of small satellite stations out there, displaying pictures from both polar-orbit and geostationary spacecraft.

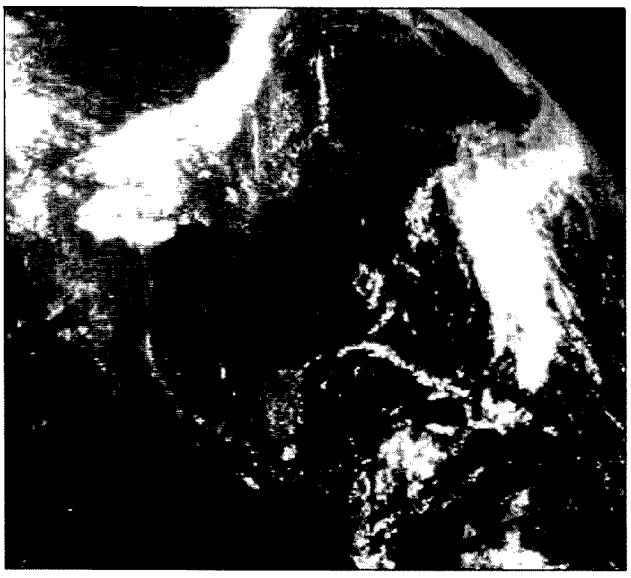


Photo A. NE WEFAX quadrant, imaged by the GOES E geostationary spacecraft and relayed by GOES Central, covering most of the U.S. and Mexico and part of Central America.

In the beginning, all of these satellites were "made in the U.S.A.," but they proved so valuable a tool in forecasting and the development of predictive models that other nations began to orbit their own meteorological spacecraft. The European space organization now operates its METEOSAT spacecraft in geostationary orbit over Africa, and the Soviet Union has a very effective system of operational polar-orbit spacecraft.

No matter where you are in the world, you can have the opportunity to view your region from space four or more times each day. If you are within range of one of the several geostationary spacecraft—and that includes almost everyone in North America, South America, Western Europe, and Africa—you have access to more than 100 pictures per day, covering your own region, with lots of material from elsewhere in the world as well. It will be one of the tasks of WEATHERSAT to keep you informed about all of this action!

It is quite appropriate that *73* should be carrying this column, for this magazine has probably published more articles on weather satellites and facsimile technology than any other major publication in the world. This tradition will continue, but a column like WEATHERSAT provides the opportunity for continuity in coverage that you simply cannot have

with individual articles treating specific subjects or projects.

The challenge in running a column of this type is great, due to the breadth of the subject and the wide range of experience in the potential audience. Even the simplest weather satellite station incorporates VHF or microwave antennas, low-noise VHF receivers (with or without a microwave downconverter), and picture display equipment that may run the gamut from simple CRT display terminals through electronic/mechanical facsimile recorders to stand-alone or computer-assisted scan converters. Some involvement with computers, if only to assist in tracking, is inevitable, and that involvement can become quite extensive (although not necessarily expensive) in the case of more advanced projects.

The audience, of course, ranges from beginner to experienced experimenter, but labels like "beginner" can be misleading. Some beginners are competent radio amateurs with a good background in antennas, receivers, and other aspects of electronics. The problem faced by these people is quite different from that faced by individuals starting from scratch in all aspects of the hobby.

Input by Me and Thee

Can a column like WEATHERSAT cover all this territory? If by "cover" you mean an exhaustive treatment of everything, the answer is a simple NO! On the other hand, it is possible to serve as a useful source of information on the satellite systems, new techniques, commercial equipment, and a basic analysis of different areas of importance in setting up and operating a satellite system.

I know my way around this hobby, but in running a column of this sort it is essential that I get connected with every possible source of relevant information. I am taking steps to ensure that I stay current from the governmental end, but it is also necessary to keep in touch with the people who are doing interesting and innovative things—essentially the more experienced end of the reader spectrum.

If you have worked up an interesting weather satellite project, consider doing a full-fledged article—*73* would certainly be interested, as would other publications. The important thing is to get it out so that others can use the information. If the project, idea, tidbit, or whatever is less extensive, then pass it along and I will see that it surfaces in WEATHERSAT. I can accomplish a lot with the column using my own resources, but I can do even better with the active cooperation of other experimenters.

When you are first getting started (and even later), you may come up with questions that just don't seem to be treated in anything you have read. Others may have similar questions. Pass such questions along and I'll make an effort to regularly treat them in the column. For some, I may not have all the answers, but we will get the problem into print and pass along contributions from the readership in later issues.

News Items

One thing that must be kept in mind is the reality of deadlines in the mad world of publications. Some of the things that I would like to do will be limited by such deadlines. This introductory column, for example, was written in July. If you wait for something to happen and then report on it, it will be a bit dated by the time it appears in print. In contrast, should you indulge in a bit of prediction, you may end up looking very current in your coverage or blow it and stand up tall with egg on your face.

Treatment of current "news" items in the weather satellite field is thus obviously limited by deadline considerations. Some of the "news" items must inevitably be a bit dated to the experienced, well-connected satellite station operator, but that person doesn't need the news function that the column will provide. I will include such information for the benefit of those for whom it *will* be news!

Polar-Orbit Predict Data

Orbital prediction data for polar-orbit spacecraft is another area impacted by deadlines. Long-term predictions of satellite passes for spacecraft in relatively low orbits are a complicated business. The complications all involve factors that result in short-term and long-term changes in the geometry of the orbit and its period. Even making allowances for such factors, based on the history of an individual spacecraft, making predictions over a period of several months introduces errors of up to several minutes in equatorial crossing times and of several degrees in the crossing point. These errors are sufficient to make such long-term predictions unsuitable for *precision* tracking, although the information is more than sufficient to know *when* to listen for a particular satellite, particularly if you are using an omnidirectional antenna.

If the predictions went to *73* along with the column manuscript, predict listings would require a three-month projection. The flexibility of the *73* editorial staff permits me to cut this to two months by feeding them figures while the copy is actually in preparation, and this is a big help. We will start by providing monthly data on the U.S. TIROS/NOAA polar orbit spacecraft. If there is sufficient interest *and* someone out there has access to suitably precise orbital data, we might later include some of the Soviet METEOR/COSMOS spacecraft as well.

Date	01 October 1986	
Spacecraft	NOAA-6	NOAA-9
Orbit Number	37750	9276
Eq. Crossing Time (UTC)	00:18	00:14
Longitude Asc. Node (Deg. W.)	86	141
Nodal Period (Min.)	101.128	102.085
Frequency (MHz)	137.50	137.62

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 1. TIROS/NOAA orbital predict data.

Circuits and Projects

Another aspect of the column will be projects and circuit ideas. Big projects from my end will be handled in articles, but I will regularly include small circuit modules of interest, either of my own design or interesting ideas contributed by readers. Some of these will be fully engineered circuits, while others may be as tenuous as a new idea or approach that has not been fully evaluated. If we can keep everything suitably labeled, you will know whether you are dealing with a simple "cookbook" project or something to tinker with. I have innumerable examples of such little projects, none large enough to justify a complete article, but all of which are interesting and effective. I am sure that some of you have some of the same kinds of tidbits, and WEATHERSAT will provide the opportunity to share them with others (suitably credited, of course!).

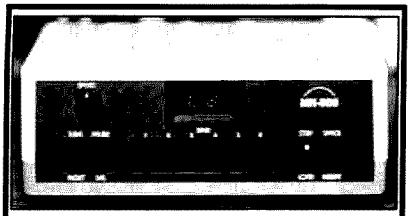
Computers

The most obvious application for computers in the area of weather satellites is doing orbital calculations, but this is only the tip of the digital iceberg. Today even the most basic home computers can be used to automate the operation of your station: by recording satellite passes when you are off at work or vacation, by processing imagery in conjunction with an existing display system to enhance contrast or bring out specific details of interest, or by functioning to control a video scan converter to enable a conventional TV set or monitor to display satellite pictures!

Orbital predicts and station control can usually be accomplished in Basic, meaning that the project can be adapted to almost any computer. Image processing and scan conversion, however, require extreme speed, which can be achieved only with certain compiled languages or, more commonly, at the level of machine language or assembly language. These programs are very specific to the microprocessor used in a specific computer and are often machine-specific as well.

There is no way for me to try to instruct you in all of the possible kinds of assembly/machine language programming, but I will, on occasion, treat the *design* of program modules—basically approaches to handling image processing problems that should be applicable in a wide range of situations. Occasionally, I may present specific examples of programming code for the Radio Shack Color Computer or the IBM PC and clones—the latter because they are so universal, and the former because it is so inexpensive yet flexible.

You might also expect to see



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information on newly available programs or computer products with weather satellite applications, and I may occasionally be arrogant enough to include review comments. Here is another area where reader input is significant, for, while I am running Color Computers and PCs, I am not about to get one of every possible home or business computer. And if we are to cover products for other systems, your input, along with that of the equipment/software vendors, will be important.

The *Weather Satellite Handbook*

One very significant source of information for weather satellite enthusiasts over the years has been the first two editions of my *Weather Satellite Handbook*. The second edition has been out of print, causing quite a bit of consternation to those who would like a copy. To make a long story short, the *WSH* is back in the form of a third edition. The book has almost 40 more pages than the second edition (the *New Weather Satellite Handbook*), and virtually all the construction projects are in a new, modularized format. Many of the circuit modules are used in more than one project, and even if you choose to rebuild a module for a new project, you are familiar with it and have a working copy to compare with the new one! Computer coverage has been expanded considerably, including a universal PREDICT program in Basic and both theoretical and project treatment of digital scan conversion.

The entire structure of the third edition has been modularized to make it simple to update with the passage of time, and printing runs are kept small to facilitate this. I will continue to shamelessly promote the book for two reasons. First, it is being published by yours truly, and unless I sell some my wife will mutiny and that will be the end of the third and future editions. Second, in all modesty, it has been and is a supremely useful reference for both new and experienced satellite experimenters. It is available directly from me, at the address above, for $12.50 postpaid in the United States and Canada and for $14 elsewhere.

Pictures

In order to communicate some of the excitement of what we do, I intend to include satellite pictures in the column on a regular basis. For the first few columns, any of these will naturally be from my own files, but submissions from readers are encouraged. Such pictures provide a way of illustrating a wide variety of satellite products, not to mention the kind of quality that can be obtained using home-constructed equipment.

If you send in some pictures, please include only photographic or FAX prints, as slides are difficult to handle. In addition to basic information as to the spacecraft and image coverage, be sure to include information on the receiving and display system you used to produce the picture.

This month's specimen is a NE WEFAX quadrant, imaged by the GOES E geostationary spacecraft and relayed by GOES Central (see Photo A). The image covers most of the United States and Mexico and part of Central America. The picture was obtained in visible light, transmitted on 1691 MHz, and displayed on a standard TV monitor using the scan converter described in the third edition of the *WSH*. Display resolution is 256 pixels/line with 256 lines and 16 grayscale steps.

I have already noted the problems inherent in deadlines. The other major problem in running this column will be space. I have been allotted a limited amount of copy each month. *73* has been positive in its coverage of weather satellite topics in the past, and WEATHERSAT represents a new and tangible expression of that support.

Your support of this venture has three dimensions. First, contribute ideas, information, or questions when you think you have something of interest. The remaining two dimensions are interrelated. Every once in awhile, drop a note off to the friendly publishing/editorial staff to tell them what a wonderful idea it is to have a column like this in their magazine and, just as important, *buy* the magazine. The most cost-effective way to do that and not miss any coverage is to subscribe. Subscriptions make publishers very happy, and happy publishers are very flexible about continuing to invest in columns like this one.

Next Month

Next month we will look at the general subject of satellite receivers for the VHF range. ■

"When You Buy, Say 73"

NEVER SAY DIE

from page 10

ago—I don't recall if I ever wrote about this.

It seemed that one of the graduates of a local Brooklyn street gang had come to him with a wild story. Several of his gang had joined the Air Force and had managed to get assigned to the same SAC group. They were waiting for the time when three were on the same flight together and then they planned to take over the plane and grab the nuclear bombs.

The idea was to set one up in Manhattan with a remote trigger and then demand a one-billion-dollar ransom—plus other demands. The government would have no choice but to pay and do anything else they asked, no matter how unreasonable.

The gang member who spilled the beans stopped the caper. The gang members were apprehended and the whole thing kept a total secret. What could the government do with those people? They sure couldn't just put them in prison and eventually free them.

My point is that, as crazy as that scheme sounds, it apparently came close to actually happening. One way or another, some group is going to get hold of a nuclear bomb. Fanatics will explode it where it'll do the most harm. Gangsters could demand more than we could give and detonate it—perhaps as a warning. If they had one they could have two.

When the nuke goes off we're going to have the same situation as California, only on the East Coast. Thousands to millions dead and perhaps tens of millions injured. That's going to take a lot of communications. You want to do anything about it or shall we just go on as we have and wait it out?

OLD FRIENDS

Are you taking advantage of the opportunities amateur radio offers you to find and develop friendships? Despite my wide range of interests, the friends I remember most fondly over the years have been ham friends.

Back in the late 40s I shared the low end of 75m with one Sam Harris W8UKS. Sam had a wonderfully wry sense of humor, so we got on famously. It was a bit frustrating for me when his 50 Watts of AM would knock my kilowatt out of the picture in South Africa. I had a pretty good dipole—Sam had a bi-square—so the ZS we'd talk to would tell Sam he thought he heard a slight heterodyne when I'd try to break in. Bah!

When I moved to Cleveland (changing to W8NSD at the time) to work for WXEL as a television director in 1951, I of course drove out to see Sam and his wife, Helen. I was surprised to find them living in the basement of their home. Well, Sam was building a house, so he first built the basement, then moved into it, and then quickly built his 120-foot tower. That's all the further he'd gotten with his home when I visited, ham priorities being what they were with him. His bi-square antenna hung from the tower. To turn it, Sam had to run out of the basement and trot the two sides of the antenna around with guy ropes. It had a whale of a signal—everywhere.

"When someone you're talking with over the air sounds like fun and he says why not come over—indeed, why not? And maybe bring some cake."

Sam, who died a few years ago, was a brilliant technician. In the 40s and 50s it was very unusual to run into someone with a beard—so naturally Sam wore one. I asked him if he noticed the stares it drew. Well, now and then he said he did—and wondered if maybe his fly was open.

Sam eventually moved to Medfield, an outskirt of Boston, to work for Microwave Associates. He had a basic mental problem—he had to have the loudest signal in the world on a band before he could be satisfied. This got him involved with some of the first moonbounce work on 2m—I think he had 14-elements on 20m. He changed his call to W1FZJ—then to W1BU.

When I took over *CQ* as editor in 1955, I got Sam to be my VHF editor. I'll never forget a great article he wrote on a contest 100-Watt final—complete with pictures of his finals. He had pairs of 1000-T finals, as I recall, for each band—running around 10 kilowatts or so each—all lined up around what had been his garage. I understood the FCC monitoring station in the next town had to shut down when Sam went on the air.

The article explained that the plate ammeter read a little high for 100 Watts—Sam suspected rf might be causing trouble. Sure enough, a quarter-inch bar of copper across the meter terminals shunted the rf and produced the expected 100-Watt reading.

This article was in response to the high percentage of operators who were winning the ARRL Sweepstakes contest by claiming to run only 100 Watts, thereby getting a 1.25 multiplier. Their rigs would be listed in *QST* with outlandishly high-powered finals—and 100 Watts input.

Sam was doing well until I moved to New Hampshire in 1962, soon after I started *73*. By 1963 I'd bought a mountaintop VHF location and set up 336 elements on 2m, 200 elements on 220, 400 elements on 432, and 16 elements on 6m. My 2m rig ran a kilowatt of rf with 4 kW of audio, producing a rather potent signal—all this from high up on Mt. Monadnock, the highest mountain in southern New Hampshire. Sam was stunned.

My 2m final was an old war surplus FM amplifier using 4-125As, modulated by the remains of a pre-war National 600 modulator, a beaut using Thordarson CHT transformers which I'd bought back in 1946—one of the better used-rig buys of my life. It easily punched 4 kW of audio into the final, providing a significant signal all down the East Coast; 600-mile contacts were common.

The next thing I knew Sam had moved to Puerto Rico and was gearing up the 1,000-foot dish at Arecibo for ham communications. Well, I couldn't top that!

Sam is the chap who invented the parametric amplifier, the device which added much to the range of military radars. He invented it on 6m and it was this device, I believe, which put Microwave Associates into big bucks. They're now MA/Com, the main outfit making satellite decoders.

Sadly, Sam was a heavy smoker—as was Helen W1HOY. This, I'm sure, shortened his life at least 20 years. We've learned recently that when a person dies, the spouse's immune system often weakens. Helen died not long after Sam, losing us a world-class 6m operator.

Now and then I'd get a chance to visit Sam—in Medfield—and then at Arecibo. We had a great time talking amateur radio, which he loved dearly—with Helen bringing him cups of coffee and perhaps some ice cream with blueberries. I don't think I remember a sit-down meal—just informal snacks now and then, brought to the operating desk.

Sam was a great ham, a wonderful technician, fun to talk with, and a solid friend. It's hams like Sam and Helen who have helped make amateur radio mean so much to me.

Another very good ham friend of mine has a wife who hates hams—including me, I suspect. All kinds.

Immediately after World War II I got back on the air—first on 112 MHz (two and a half meters), which was the first post-war ham band to open—then on 10m, which opened a few weeks later. I was stationed at New London, teaching radio and radar at the Submarine Base—having been transferred from my submarine in the Pacific just before the war ended. On weekends I'd drive home to Brooklyn, where I got on 10m.

Two of the more active hams at the time were Eddie Ricca W2OCL and Frank Rizzo W2OCM. Groups of local hams would often get together at Eddie's house in the evening to ragchew—and be served coffee and cake by his wife, Jeanette. Eddie was a projectionist at a local race track—he later moved to Florida and got involved with the International Traffic Net up in the 14.300s.

We built up quite a bunch of hams around Brooklyn on 10m in the evenings. The band was closed, so it was much like the old pre-war 160m band. We'd gather a group of maybe ten or so joshing each other and then someone would suggest meeting at Nathan's at Coney Island for a hot dog. We'd all drive out there and nosh. Nathan's, by the way, had the best hot dogs in the world.

Another old-timer I remember

fondly was Garald Silsby W1MCS, from my home town of Littleton NH. Sil ran a radio repair store in town and operated a 25-Watt 80m CW rig from his camp on Partridge Lake. He did radio repair the old-fashioned way—if a transformer burnt out he'd rewind it, not just reach for a replacement.

Then there was the first chap I contacted the day I got my ticket—Dexter Poindexter W2MCV. Dexter was the sort of ham who pored over the ham magazines endlessly, talking for hours on either 2.5m or 160m about his next big receiver purchase. Dexter lived for the day he would finally decide what receiver to buy. Alas, he spent more time than he had on the decision, dying before he bought the receiver he'd dreamed of for so long.

My rig was a 2.5m walkie-talkie built from an article in *Radio*—kind of the pre-war version of *73*. Two tubes and a pair of long lines for a tank circuit.

Hams still ask me about John Williams W2BFD—he died fairly young in 1961—smoking killed him. John was certainly the father of RTTY. He made the first deals to rescue Teletype machines from Ma Bell. He warehoused and distributed them. He designed the first circuits—which I suspect are much better than many we're using today. He (with help from me) set up the first two-meter repeater in the country to repeat RTTY throughout the greater New York City area. It was controlled on channel so the FCC was furious, wanting him to set up a separate 220-MHz control link. It worked beautifully.

John had other interests, too, as I found out one day when the FBI visited me. I later found out his electronic genius was also spent on making state-of-the-art surveillance equipment. He mentioned once providing the Arabs with bugs to put on Israeli diplomatic cars so they could hear what was being said inside.

John was careless, at times to the point of being crooked, with the delivery of Teletype equipment. But most of us used his designs and were held together by his signal from Woodside, Queens—and then by his repeater.

He built one of the first telephone answering machines. I've still got it down in my basement. He used a homemade phonograph record to answer the phone and a wire recorder to record the incoming messages. Bell really hated this, but John stood them off until he died. He lived about a mile from his radio repair store and connected the two via 162 kHz over the power lines so he was able to talk over his store telephone from home. Not bad for the 50s.

I met Walt Chamberlin W6LLP when he came to New York to install a color organ on a Guggenheim Fellowship. If you've seen the Guggenheim Museum on 5th Avenue, the color organ is the reason it's such a strange shape. The color organ was supposed to be the centerpiece, so Frank Lloyd Wright designed the building around it.

Walt was into RTTY, so he looked me up when he got to New York. He'd helped the color organ inventor, Charles Dockum, build his first test model and came with him to help build a bigger one.

Once the new color organ was up and running, Walt went back to Pasadena and I took over as the engineer on the project—mostly to keep it running. It was a great invention, but it took a lot of control equipment and power tubes to run the four 70mm film projectors, each with three films controlled independently. Alas, today you can do everything it could do—and more—with microprocessors, and you wouldn't even need the projectors.

I had more fun composing color/light programs on the organ than keeping it working and developing new circuits. Alas, eventually a new museum director was appointed and he nixed the color organ. It may still be sitting somewhere in a warehouse for all I know.

The organ was set up in the old Guggenheim building, on the same site as the present one. While I was working there I operated on 2m from the penthouse apartment overlooking Central Park. It was a great location.

I used to visit Walt in Pasadena in the 50s. He went to work for NCR making computers, and we drifted apart as I got to L.A. less often. I don't see him listed in the *Callbook*, so perhaps being a vegetarian didn't keep him alive. I can't imagine him dropping his ham ticket.

Oh, there've been many hams I've known down through the years—some wonderful people. But you have to take time to develop friends. When someone you're talking with over the air sounds like fun and he says why not come over—indeed, why not? And maybe bring some cake.

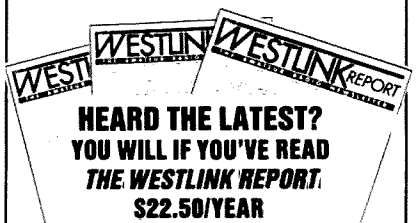
Here you have the whole world at your fingertips—thousands of fascinating people anxious to talk with you. You sit down, turn on the rig switch and there they are. If you want to be alone, off goes the switch and you're by yourself. If you want good friends you're going to have to work at it—and you'll get out everything you put into the relationships, and then some.

Of course if you're a snide, sarcastic, put-down person, the more you put into a relationship, the less you'll get out. You might want to tape a few contacts and then sit down and listen carefully to them to see what kind of a person you are to contact. Are you someone you'd call again? Some people are so used to being negative they spread gloom with every contact. It can take hours to air out a frequency after a couple of chaps like this have been bitching.

You might want to explain that hamming is supposed to be fun the next time you hear a curmudgeon griping—but be prepared for the blast of fury. No, I don't think you'll find anyone with the guts to back you up—you're on your own in trying to improve our bands. The most infuriating thing you can do is be unflappable.

Both you and I will enjoy hamming much more if we do our best to avoid the rotten operators and look for the chaps who are fun to talk with—who are worth developing as friends. ■

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73 INTERNATIONAL

Number 28 on your Feedback card

NOTES FROM FN42

There are many activities around the world that could be reported here—which *you* could tell us about firsthand if they were happening in your country... much better than we could, using secondhand information. The July issue of *World Press Review*, published in New York, excerpted from press reports on new satellites in Japan...on the personal computer boom in the Ivory Coast and Senegal Republics...and on an aspect of the government in Norway, which perhaps could mean more Norwegian YLs and XYLs.... Is there anyone out there who can tell us more than the following?

NKH (Nippon Hoso Kyokai), Japan's giant public broadcasting system, is experimenting this month with the new television satellite, the BS-2b; its made-at-home BS-3 is scheduled to fly in 1988. NKH *encourages* private dish antennas; half a million are expected by 1988. (From remarks in Tokyo to *WPR*'s "World Beat," by Norio Shimamura, NKH editor for foreign news.)

Personal computer nets are popular in two African countries, Ivory Coast and Senegal; Senegal reportedly unveiled the first PC to be designed and built in Africa. It is a computer boom, according to El Inkichari, in the Paris *Le Journal de L'Economie Africaine* [5/15/86].

Is the Norwegian Telecommunication Direktorat headed by an XYL or YL? That's a reasonable question since Norway now leads the world in the number of women in top governmental leadership positions: Gro Harlem Brundtlandt is Prime Minister, and she has named women to seven cabinet posts—which is nearly half of that body. (From an article by Birgit Wiig in Oslo's *Dagbladet* [5/20/86].) If so, could that not lead to an increase in the number of YL and XYL ops in that country?

Let's hear from *you* (particularly if you know more about the above) and from more countries. This is an *"International"* column! We've "flown the flags" of 59 countries so far, with no nationalistic sort of favoritism (amateur radio is an *international* hobby) —let us "fly" your flag, too.—*International Editor.*



ARGENTINA

Marcelo "Mac" F. Avila LU5EIC
Radio Club Boulogne
C. C. 39–(1609)
Boulogne Sur Mer
Buenos Aires
Argentina

I've much pleasure writing you about the new special callsign that began appearing this year and will be used through this month [October]. The Secretaria de Estado de Comunicaciones (Communications State Secretary) has authorized Argentine amateur radio clubs to use the AZ1ARU callsign to commemorate the IX Plenary Assembly of IARU Region II in Buenos Aires this month.

The Radio Club Argentino (LU4AA) uses the call without the portable; all other ARCs use one, as mine (Radio Club Boulogne) uses AZ1ARU/15, that can be considered as an AZ15 prefix.

All stations have a QSL Manager, using his own or the club callsign (Radio Club Argentino uses its own; Radio Club Boulogne uses mine: LU5EIC). Be sure to use the QSL information you are given by any AZ1ARU station you contact!



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

DOC GETS TEETH!

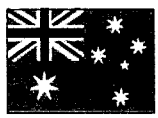
Thanks to the long-awaited replacement of the 80-year-old Wireless Telegraphy Act with the Radiocommunications Act, the Department of Communications now has a "vitally important" tool for the efficient management of the radio-frequency spectrum. There is a vast range of uses being made of the spectrum, and the new Act recognizes the modern electronic environment and the issue of electromagnetic compatibility (EMC).

Formulation of the Act over the last 15 years involved the slow process of consultation with manufacturers, importers, and all spectrum users, and the Wireless Institute of Australia was a part of the process through its CASPER Committee; all this will continue as regulations and standards evolve.

DOC will have new powers to deal with all forms of radio frequency interference, from *all* sources—power lines, electric motors, welders, thermostats, and so on. TV sets, VCRs, stereo units, intercoms, and other such devices sold in Australia will have to meet standards of immunity to RFI. It will be an offense to supply, possess, or use equipment manufactured after the setting of standards which does not comply with those standards.

The Act redefines a number of new offenses, such as using a transmitter that causes interference to safety communications, harassing another person, or sending hoax calls. In the last category, differences are clear from two hoax cases, the first prosecuted under the old Act and the second under the new. A Queenslander who made repeated calls to emergency services on marine distress channels, claiming he was in a boat with others outside the Southport sandbar when he was, in fact, transmitting from his home on equipment borrowed from an equally unlicensed friend, lost the equipment and was fined $300 plus costs. Just recently, another Queenslander made straightforward distress calls to the Cairns Coastguard—and he was fined $2,500 and lost a $150 marine transceiver and a $200 CB transceiver.

I must thank the WIA's amateur radio magazine and Mr. Bill Palmer, DOC Public Relations, for the above information.



NORFOLK ISLAND

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island, 2899
Australia

When the Pitcairners stepped ashore on Norfolk Island in 1856, they looked around them in amazement. These were the second and third generation descendants of the famous Bounty mutineers who had sought refuge on Pitcairn Island after casting Captain Bligh adrift in an open boat.

As generation followed generation, Pitcairn Island had become too small for the 193 descendants. A larger island was needed, preferably one where they could continue their isolated existence free from interference from the outside world. So Norfolk Island had been offered for their new home. The penal colony had been closed, leaving buildings, fields, and livestock for the Pitcairners' use.

The people, after an exhausting voyage of over 3,000 miles, lasting five weeks, felt bewildered. Stone buildings, some two or three stories high, looked large and formidable. And the herds of cattle grazing were something new. They had had nothing like that on Pitcairn.

Many found it difficult to settle down in these new and strange surroundings. Their very life style was changed. And before long, several of the Pitcairners contemplated a speedy return to Pitcairn. Two and a half years after their arrival, two families returned to Pitcairn Island. An extract from an old diary on Norfolk Island reads: "...after a scene of sorrow and pity, several of the relatives going into hysterics, etc., they embarked and in the afternoon sailed...."

In 1864 a second group departed Norfolk for Pitcairn Island. And so we have it that the descendants of the Bounty mutineers are to be found on both Norfolk and Pitcairn Islands.

Relatives were separated for years with no news, although a few letters found their way by slow—very slow—mail. But maybe the longing for a return to Pitcairn was laid down in the Norfolk Islanders' genes. As the years passed, each generation talked about Pitcairn Island and how they wished they could see it one day.

With the coming of amateur radio, communications were improved. John VK9JA and Ray VK9RH (now SK) talked regularly with Tom VR6TC, who was the only operator on Pitcairn in those days. By 1984 the amateur radio population on Pitcairn had doubled—to two resident operators. Kari VR6KY had been active for some time, and she and I provid-

ed another link between the two Islands.

It was now that the day finally came to pass that generations of Norfolkers had longed for. A group of people from Norfolk Island travelled via New Zealand and Tahiti, then onward by chartered vessel, to Pitcairn Island...and the way these long-lost relatives greeted each other gave no indication of the passage of 120 years since the last group had departed Norfolk Island for Pitcairn.

Anticipation had been strong. On Norfolk Island we received via amateur radio hasty little progress reports from Pitcairn while the group was en route. "We are busy baking extra bread...we are giving our houses a good spring clean...do you know the names of those coming here?" And then finally, "The men are all up in the hills on the lookout for the ship!"

Oh, joy! Eight days of talking, laughing, exploring the island, singing, and feasting. Then time for departure.

The bonds between the two islands had been strengthened. Fortunately, propagation was not too bad in the months that followed, and one day Kari and I set up a special Christmas sked. She would gather a group of Pitcairners in her house and I would gather a group of Norfolkers in my house. A little mike-shy to begin with, "my" group soon warmed up. So did "Karl's" group. Soon everyone was bubbling over with things to say, questions that wanted answers, and promises of visits to come.

Pitcairn and Norfolk have their own version of the English language. Called Pitcairnese and Norfolkese, it is a mixture of 18th century English and Tahitian words adopted from the mutineers' Tahitian wives. The language has survived successfully even here on Norfolk Island, which has been subjected to a large influx of new settlers. So the one-hour Pitcairn/Norfolk sked was conducted in their own language. Later, to tidy things up, Kari and I tied the ribbons on the sked in Norwegian!

The exercise proved that amateur radio is an excellent medium for keeping isolated communities in touch on a more personal basis than telephone calls or infrequent letters. At present propagation is too unreliable, but once that improves Kari and I will resume our regular skeds, helping to strengthen the tie between these two islands which share an interesting chapter in the history of the South Pacific.



BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena, 49/701
20270 Rio de Janeiro
Brazil

CW GOLDEN HOURS

It happened in Rolandia, Parana State, when Flores PY5BXW suffered a heart attack which damaged almost three-fourths of his heart and left him unable to move except for slight finger wiggles and winking eyelids.

Taken to the hospital, almost no hope given him by the medical team, unable to communicate in any way, Flores seemed condemned—when his wife, Cida, remembered CW and asked her son if he thought Flores would be able to understand a CW message. Her son called on a friend of Flores, Rossini PY5CFT. At the hospital emergency center, earphones were placed to Flores' ears and, by Morse code, Rossini asked Flores to wink his eyes if he understood the message.

There was winking, and Rossini told Flores that he was going to put an oscillator key under his fingers, hoping he would be able to express his feelings.

Then, like a miracle, Flores started slowly but steadily to send a message about some strong pains, thus allowing immediate help from the medical team and bringing Flores such relief that the whole situation was changed: Calmness and courage resulted in new hope. The medical team was astonished with what they were seeing, never having imagined that a motionless patient could ever communicate information about himself.

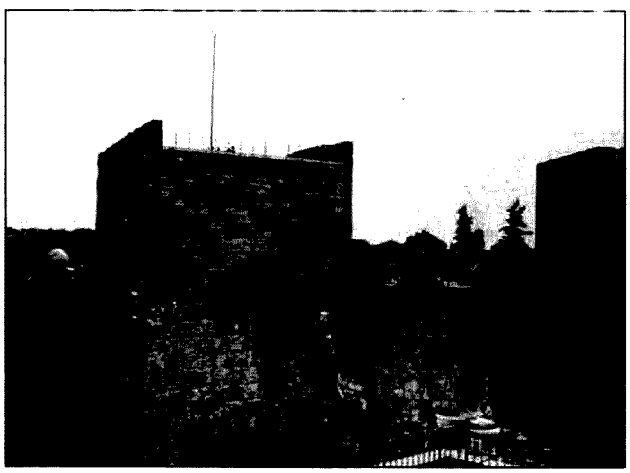
Rossini stood by from then on, always ready to copy Flores' messages and translate them to the medical team and family. Anguish and the barrier of silence were surpassed, and little by little Flores' CW messages poured from his fingers, instructions to his sons about how to take care of the farm and lands– and of everything else, showing that Flores knew how severe the heart attack had been.

"Cida, if anything happens, I want you to know you were the happiest thing in my life..." was one of his messages.

Morse code. What so many have called "good for nothing" cannot be judged if measured or imagined by common parameters. Is it worthwhile knowing? Well, "knowing takes no space and has no weight...."

Unfortunately, Flores could not stand such a severe infarct and died three days later. "Rossini, I feel I'm going to die," was Flores' last message, this one very hard for Rossini to get despite his CW skill.

Although he dedicated his whole amateur radio life to CW operation, we don't think Flores ever imagined he was going to write such Golden Hours to CW, a so important example for us all to think about.



The site of 4X5J, David's Tower on the walls of the Old City of Jerusalem. The station was housed in the room under the tower for the tribander. (Photo by Eli Hadashi)



ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev M. P. O. 85530
Israel

ACTIVITY WEEK—OLD CITY OF JERUSALEM

Readers of my April and September columns last year, here in *73* International, will recall the 4X5DS expedition to the lowest spot on the face of the Earth, the Dead Sea. The Holon Bat-Yam Club, which pulled off that operation, decided that this year they would do a similar week-long stint, but this time, as Aharon 4X4AT put it, to the highest spot in the world—spiritually speaking. Hence, the 4X5J operation.

After careful preparation of equipment and skyhooks and securing the necessary authorizations from the authorities-that-be, the station was set up in David's Citadel just inside the Jaffa Gate of the Old City of Jerusalem's walls. The time: from the 24th of April through May 1, the week of the Passover festival, when schools and many businesses are closed, ensuring sufficient numbers of operators for around-the-clock activity.

It would seem that the operation enjoyed the full support of nature, as the tribander and dipoles perched on the Pata'el Tower, two transceivers and their amplifiers performed flawlessly throughout the week-long period. Not only that, but conditions were excellent, especially for this juncture of the sunspot cycle. The evidence: over 8,000 contacts with 120 countries and 47 American states.

Publicity wasn't lacking, either. Israeli television was on hand, and the viewing public was treated to a four-minute-long item on the late-night news showing antennas, the station in operation, and an interview with the chairman of the Israel Amateur Radio Club (IARC) explaining the importance of the operation. Israel Radio's English language service also devoted time to the activity, and on Ben Dalfen's DX Corner (4Z4JS) on the Overseas Service, listeners received full information on 4X5J.



Mayor Kollek signs a QSL card as Aharon 4X4AT watches. Standing, from left: Amos 4X6PH, Amir 4X6TT, an unidentified SWL, Asaf 4X6MH, Shoshana 4X6OL, and Dudu, the manager of the David's Citadel Museum.



The 4X5J QSL card shows The Citadel.

Mayor Teddy Kollek of Jerusalem paid a special visit to the station and made a contact in the German language with DJ8OT. The public, including many tourists, also visited, and, indeed, the activity was such a hit that the curator of the King David's Citadel Museum, in the rooms of which the operation was housed, invited the operators to return each year, making it an annual affair.

A revival in activity on HF took place with the Jerusalem amateurs, who discovered that with 4X4J operation hams worldwide were interested in the coveted Jerusalem Award. As a result, they pressed their stations into activity and found themselves to be very much in demand.

Jerusalem Award Changes

The requirements for the Jerusalem Award have been considerably relaxed, making it much more readily available for most amateurs. All that is required now are contacts with four *different* Jerusalem stations, and no more. QSLs are not necessary—just a log of the contacts verified by two other licensed amateurs, sent along with four IRCs to the award manager, Dr. Milt Gordon 4X6AA, PO Box 4079, Jerusalem, Israel. However, if you were fortunate enough to make contact with 4X5J, then the Holon Bat-Yam Club will take care of all expenses for the award and no IRCs will be necessary. Send your log, with the record of the contact, to 4X5J, c/o The Israel Amateur Radio Club, PO Box 4099, 61040 Tel Aviv, Israel. To the best of my knowledge, the club is already sending out OSLs for all contacts with 4X5J, making absolutely no solicitations, in the same way that they handled 4X5DS last year.

In summation, the 4X5J operation was a big success. Thanks are due to scores of hams who gave freely of their time, equipment, and funds to make this DXpedition the triumph that It was. The Holon Bat-Yam has some different plans for next year. What they are is not yet known, but I shall try to inform you in advance!

BIG EXAM TURNOUT

While amateur radio seems to be declining in many countries, it seems that the great publicity received by ham radio in Israel coupled with hard work by the Elmers or counselors at the various local clubs has really paid off.

In the spring examinations for the amateur radio license, 170 examinees came for the three different license classes! The results are not out yet, but according to IARC volunteer observers, the percentage of those passing was high.

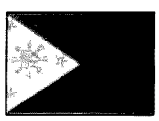
Although according to a survey made on the air that most amateurs here would favor some kind of code-free license giving some kind of VHF privileges, the Ministry of Communications still does not favor the idea. Even so, amateur radio here is still growing; but it would seem that we're losing many talented youngsters to computers as a result of the licensing requirements.

VISITOR LICENSING

It's time to remind you that when you visit here you should bring along a small, two-metre hand-held and meet the hams here, thus adding a beautiful human dimension to your trip to Israel. On a radio program recently I heard the figures regarding the number of murders per capita in large cities in America and Europe. It was interesting to note that in spite of the big terrorist scare keeping people from going outside the borders of the U.S., the number of those meeting violence in Israel is *considerably* smaller than that of major American cities. You are immensely safer on the streets of Jerusalem or Tel Aviv than in New York, Chicago, L.A., Detroit, etc., and you can stroll safely at all hours.

If your country has a reciprocal licensing agreement with Israel or if you can provide proof that Israeli hams receive licensing privileges in your country without additional exams, then when you come bring your valid amateur license with you (NOT a photocopy). Your reciprocal license shall be granted on the spot, free of charge. Just appear at the Ministry of Communications' offices on the tenth floor of the Shalom Tower on Ahad Ha'am Street (it is Tel Aviv's tallest building). Office hours are 9 a.m. to 1 p.m., Sundays through Thursdays; the phone number is 610-278 (dial 03 first from outside Tel Aviv).

I'll write soon to bring you up-to-date on all the repeater channels. Hope to work you on two metres—remember, Israel loves visitors!



PHILIPPINES

(We are half chagrined, half confused, and half pleasantly mystified about the material we published in the March, 1986, issue from Senor Leo Almazon WA6LOS/DU2, our Philippines correspondent. It included interesting information about a February, 1985, Hamvention—not exactly hot *news, but in this column that doesn't matter—and went on to mention "the plan for the next SEANET convention. . . in DU-land [and] the tentative dates are November 22 through 24. . . ."*

(It was too late to do anything about that when we suddenly realized that that SEANET affair had already been held, five months before, in November of 1985.

(Now we have more material from Sr. Almazon, just as interesting as his material usually is, postmarked June 24, 1986. We decided to read it carefully! *It speaks of a decision which "will be heard after the Presidential election in February." And it ends with his plan "to attend my very first Dayton Ham convention. I will drop by the 73 Magazine booth and say my hello. . . ."*

(Some of you who see American TV will know what we mean when we say we felt as if we were suddenly in The Twilight Zone! Yes, the Dayton Hamvention was held two months before *Sr. Almazon's communication to us was postmarked. Of course there is a simple explanation! We will share it with you when we find out what it is. Stay tuned.)* ■

ABOVE AND BEYOND

Number 13 on your Feedback card

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

A few months ago, I touched on the importance of 6 meters during the early (June and July) VHF contests. Many a great effort has been made by the grace of a strong Es opening on 50 MHz!

It's been a few months since the running of the 1986 *CQ* WW VHF WPX Contest, but 6 meters came through in a big way to help our group (SCORE, operating KC2PX) ring up some interesting totals.

Overall, 6-meter activity was fairly good locally. But when the band opened up, things got interesting! Just prior to the contest, there were strong Es openings to virtually every part of the country—from Newfoundland to California. These openings lasted off and on for several days and activity was detected from Minnesota to Missouri the afternoon of July 18 as I set off for our contest site.

Alas, Murphy stepped in and the scatter disappeared, but only temporarily! For the first 2-1/2 hours, we worked into New England, eastern Pennsylvania, New Jersey, Maryland, Massachusetts, and New York with signals consistently about S9 to S3. Suddenly, at 10:30 p.m., in the midst of all these local contacts, two stations from grid square DN13, western Idaho, punched through with S9 signals, and exchanges were quickly made! Our excitement rose and we were rewarded with intermittent Es openings for the next 1-1/2 hours into Florida, Arkansas, Tennessee, Alabama, and Texas.

I found myself in a rag-chew at midnight with K5UR in Arkansas and N4EJW in Florida (both stations were S9 +20), lamenting the lack of activity for such a great opening! The late hour may have had something to do with it, but 6 continued to show sporadic openings throughout the night, and many stations that we might have struggled to work on meteor scatter were "easy pickin's" via Es.

We resumed operating the next day at about 7:30 a.m., running local stations for a bit. A few meteor scatter contacts were made into the Midwest, but things were quiet until about 2 p.m. when the band opened up again, this time into Florida, Tennessee, and even as close as North Carolina! Stations were worked at the southern tip of Louisiana (EL59) and along the Florida panhandle (EL79). The skip appeared to be concentrated mostly in the Deep South, with occasional pings from Missouri and Texas.

Periodically checking the logs made for an interesting contrast since the 2-meter station was running about double the contacts, but 6 was producing twice as many prefix multipliers. More stations were bagged along the Gulf Coast, indicating the presence of an E-cloud somewhere over the Tennessee River valley. We suspected, and rightly so, that we would soon be hearing from states north of the E-cloud. Sure enough, here came contacts in EN51 (west and south of Chicago), EN41 (western Illinois), EN1Ø (southeastern Nebraska), and EN31 (Des Moines).

The 6-meter operators were busier than one-armed paperhangers at this point. It was a good opening—no terrifically strong signals, but plenty to work with—when another surprising development took placel In the midst of running the Midwest contacts, some Southwestern grids started popping through, such as DM84 (eastern New Mexico/western Texas), DM41 (Mexico/Arizona border), DNØ7 (Yakima, Washington), and CN85 (Portland, Oregon). This was getting interesting.

At this point, about 9 p.m. local time, we were working stations from Florida to Washington, with New Mexico, Arizona, Idaho, Texas, and northern Minnesota thrown in for good measure. It was one of the stranger Es openings I've seen, for despite the westward and northward trend, we never once heard a peep from California—a prefix we dearly needed. Yet, we were able to work Newfoundland at the tail end of the opening, indicating the presence of another E-cloud over the Atlantic! (Rumors floating around Sunday morning indicated that indeed G2 and G3 stations were hearing U.S. signals, and that a few contacts may have been made.)

This was the last substantial opening for the rest of the contest. During these two openings, KC2PX logged about 100 grid squares as well, making VUCC in two days. The enclosed map (Fig. 1) gives you an idea of what was worked from our location in Belle Mead, central New Jersey (grid square FNØØ). It's apparent that the E-clouds occurred mostly over the Mississippi valley and the Tennessee River valley, accounting for the activity in the eastern half of the country. What caused the openings to the west? Most likely double-hop sporadic-E, not a very common occurrence!

We finished with 234 QSOs and 81 prefixes on 50 MHz, meaning about every third station worked was a new prefix. Contrast that with a total of 379 QSOs on 144 MHz and 68 prefixes, which works out to about a new multiplier every sixth contact. No doubt about it, 6 meters is a very important band during a VHF contest.

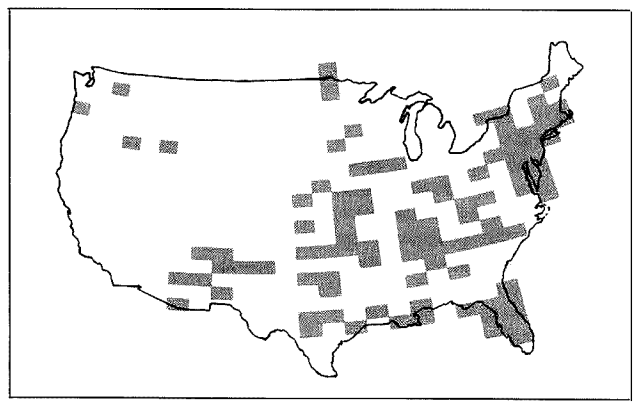


Fig. 1. Grid squares worked by station KC2PX during the 1986 CQ WW VHF WPX Contest.

Measurements

Every VHFer likes to know more about what's going on in his or her station with regard to performance. . . such as antenna gain, noise figure, power output, swr, etc. Some of these quantities are not easy to measure, but some are and I'll try to suggest some appropriate test gear that can be found cheaply at flea markets to do the job.

Let's start with the most popular measurement: power. I personally rely on Bird model 43 wattmeters and elements, but there are other units available that can do the job nearly as well. Mirage makes a nice line of VHF/UHF wattmeters that are reasonably priced in the $100 range. Also available are units from Welz (which don't have the resolution of a Bird but are reasonably close on VHF) and from Daiwa (which are less accurate than the Welz, based on my own observations).

Heathkit used to make a nice wattmeter for VHF called the HM-2102, which was surprisingly accurate. It used a toroidal coupler (as does the Daiwa) for both 50- and 144-MHz measurements. These can be found for about $25 to $35 at flea markets. The newer Heath meters work much the same way, but I haven't had a chance to use one and evaluate it. EME Electronics in Germany makes a nice multiband unit using a 50-directional coupler and voltage dividers to achieve coverage on 144, 432, 1296, and 2304 MHz.

Of course, you can roll your own, too. Circuits have appeared in the ARRL *Handbook* for Monimatches and 50-Ohm transmission-line couplers that can be made from PC board and plumbing supplies. A Monimatch circuit can also be used to indicate swr by calibrating the Reverse Power diode's output. Fig. 2 shows a typical Monimatch circuit with the bare essentials. This is similar to the cheap wattmeter I wrote up for *73* in September of 1984.

Another excellent meter that has been around for a long time was made by the MC Jones company of Bristol, Connecticut. You'll often find them attached to a resistive-type coupler in a cylinder with SO-239 connectors at either end. MC Jones also made a line of UHF and VHF directional couplers with microwave diodes that work very well. I have seen these available at numerous hamfests for about $25 for the meter

and resistive coupler, and the VHF/UHF couplers usually run in the range of $20–$30 apiece.

Last month I outlined a procedure for gain measurement using a known signal source. Where do you get the source and how do you measure it? There are plenty of surplus test equipment buys at flea markets. You might be able to find a Boonton Radio rf signal generator for a reasonable price. I saw four at Dayton this year for about $50–$75 each. They will cover up to 200 MHz in band-switched ranges. If you have a bit more cash, $200–$300 will get you a Hewlett-Packard 608 series rf signal generator, with outputs up to 450 MHz depending on the letter code following the model number.

Boonton Electronics makes many fine millivolt and milliwatt rf meters that can be had reasonably if you look hard enough. I picked up a model 902 for a song, but had to fork over $50 for a surplus 50-Ohm detector head (good to 600 MHz). This is what I use to align transverters and other low-level signal sources. I also employ a good frequency counter made by Ramsey Electronics. You don't have to spend a fortune to get a good counter, only about $65–$95 for coverage to 600 MHz if you look around.

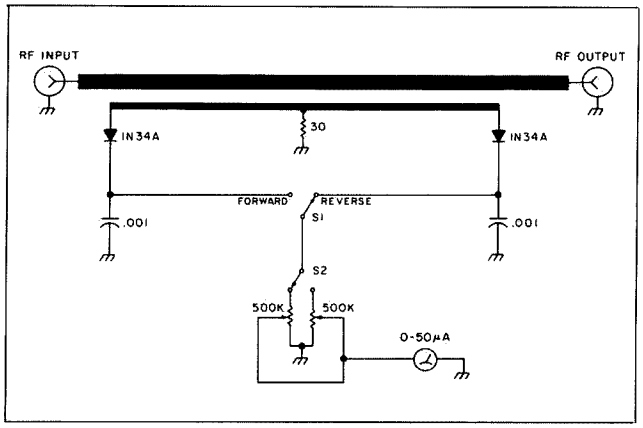


Fig. 2. The simple Monimatch circuit is the directional coupler found in most rf wattmeters.

And, of course, let's not forget the time-honored VTVM (or its modern-day counterpart, the FETVOM). This may be the most useful gadget around the shack for making voltage, current, and low-level rf measurements. You can fabricate a 50-Ohm coupler and use the VTVM/FETVOM as a meter readout for power and swr if need be. Such a VTVM might run from $25 to $50 in a flea market. As I come across other surplus buys, I'll keep you posted via this column.

Where Is Everybody?

I hear stories often of the newcomer to VHF or UHF who spends $900 for a multimode radio, antenna, and amplifier, only to complain that there's no one to work. If you tune around 432 MHz on a Saturday afternoon, that would be a valid conclusion! It's time to talk about the concept of activity hours, when your chances of making a QSO improve by leaps and bounds.

On the East Coast and in much of the country, certain hours of certain evenings are designated activity hours to encourage operators to get on the more popular VHF and UHF bands. The convention is that Monday is 50-MHz and 144-MHz night, Tuesday 220-MHz night, Wednesday 432-MHz night, and Thursday 1296-MHz night. In addition, the following hours are used conventionally for activity any night as well: 8–9 p.m. local, 220 MHz; 9–10 p.m. local, 432 MHz; 10–11 p.m. local, 1296 MHz. Also, during contests you'll find the most activity on these bands during these hours. It saves you having to waste your valuable Sunday afternoons calling CQ on 220 MHz until you're blue in the face.

That's it for this month. I'd like to hear from any readers who participated in last summer's contest schedule and their comments as well, with particular interest in portable or mountaintop operations. Until next month, see you Above and Beyond! ■

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ME AND PRESIDENT FAHRQUAR

Have you ever heard of former ARRL president Roland P. Fahrquar? Neither have I. But since I'm about to tell you a slightly embarrassing story about an ARRL president we have all known, and since I don't want to lose my house to a messy libel suit, let's just give him that name. Roland P. Fahrquar. President Roland P. Fahrquar. Sounds like a League president's moniker, doesn't it?

Anyway, our story begins at a League convention some years back. My brother Jim WB2LWJ and I had just been licensed for a few years and we decided it was time to see what these ARRL shindigs were all about. So we were in this Playboy Resort hotel in rural New Jersey, and on the first day we were in an elevator traveling to the fourth floor to see the world premiere of a brand new ham radio film, produced by the League.

So we got into this elevator. Almost immediately, I recognized the face of President Fahrquar. I mean, how could you not recognize him? Each month, his mug was literally plastered over the pages of *QST*. In the November issue alone, his face appeared no less than three times. On page 11, Fahrquar was presenting the Buckeye Amateur of the Year Award to a 7-year-old who managed to save an entire family by diverting a lightning strike through his Lafayette code practice key. Page 32 pictured Fahrquar representing the International Amateur Radio Union at the World Administrative Radio Conference (held on the French Riviera, of course). And, just for good measure, Fahrquar was shown on page 62 cutting the ribbon at the opening of the new Andy Devine Annex to League headquarters. This was a man very conscious of his public image.

So anyway, here we are all in this one elevator, Fahrquar, my brother, and me. Jim obviously failed to realize we were in an exalted presence.

"I hope this film is good," said brother Jim.

"I hope so, too," I replied.

"I hope it's not like the one we saw at the Novice class last year," he said. "That one really stunk up the room."

I began dying. I mean, after all, one does not insult a League film in front of the president.

"You know, the League has a real warped idea of what film making is all about," said Jim, now seriously into his film critic mode. "They think they can stick Arthur Godfrey and a ukulele into a picture, show the guy's million-dollar ham shack, and win over the kids. They're full of it."

By this time, I was inspecting the cobwebs on the elevator's ceiling, and Fahrquar was blowing smoke rings out of his ears. Turning toward Jim, Fahrquar, barely able to speak, croaked out, "Well, maybe you'll like this film better." The doors opened and he stalked out.

"For an instant that distressed-looking fellow in the sculpture "Ugolino and His Sons" looked like Fahrquar. Then, on second glance . . . no, of course not."

"Who the heck was that?" asked Jim.

"Roland P. Fahrquar, the ARRL president," I said.

"Golly, I hope he didn't take it personally," said Jim.

Over the course of the next several months, Jim and I ran into Fahrquar on a number of occasions. Pretty soon, we took to, as Jim termed it, "Freaking out Fahrquar."

It would work like this. Say Fahrquar was the scheduled speaker at the Hall of Science Radio Club, a popular ham radio establishment in the late 1970s. Jim and I would grab front row seats. We would dress identically in traditional ham garb: slacks, red plaid flannel shirts, and baseball caps. Fahrquar would arrive at the podium, look up to deliver his speech, and instantly see the two of us and freeze up. Jim and I look a lot alike (fat and dopey), and since we would sit there with silly grins on our faces throughout his entire speech, it would throw him into a panic, really rattle him. Maybe he thought we were aliens intent on subverting the ARRL. Who knows what thoughts pass through the brains of ARRL officials.

We kept it up. At the LIMARC flea market on Long Island the next spring, we spotted Fahrquar manning the League table. We walked up to the exhibit in unison and, in a nursery rhyme sort of sing-song, jointly chanted the words:

"We Are Here to Offer Our Services to the ARRL;

If You Don't Want Us, Just Say, 'Go to . . .' "

Well, you can guess the rest of the rhyme.

Fahrquar got a sort of ill look on his face and shooed us away.

After awhile, we got bored with the whole thing. I mean, how long can you pick on an ARRL president? It got to be kind of cruel—like teasing goldfish or stealing your pet dog's favorite bone. It just wasn't the sort of thing we wanted to keep on doing.

But then something strange happened. Try as we might, we couldn't get away from old Fahrquar. For instance, Jim and I would drive out to Harrison's, the big electronics store out on Route 110, and there would be Fahrquar idly spinning the vfo on a Drake TR-4C. He would give us a sly sort of smile and then disappear behind a rack of RCA connectors.

This happened a few times. We would go to the local repeater council meeting, and there would be ol' Fahrquar grinning at us. We would help out at the March of Dimes Walkathon in Manhattan, and there was Fahrquar, eyeing us over the top of an HT-220. What was going on here? We were supposed to be freaking him out and here he is grinning at us and making us . . . the great freaker-outers . . . feel very, very uncomfortable.

Soon, Fahrquar was popping up where he had no business being. I mean, running into the old fella at an electronics store or a repeater council meeting made sense, but how could you explain seeing the guy at a movie theater in Forest Hills or playing the slots in Atlantic City? League presidents don't play slots. I mean, what sort of an example would that set for Novices? Most Novices I'm familiar with settle for nothing less than baccarat.

There was no explanation, of course. Or was there? Sure . . . it was a League plot. Yeah, right. The League was out to get Jim and me. No, that's crazy. Why should the League be out to get us? No, Fahrquar was after us. He was giving us his righteous retribution for laughing at the film and playing gags on him at the Hall of Science. Or was he?

We were kind of confused.

Over the next few years, Fahrquar kept popping up in the most unusual places. But, unlike in the past, he became more unobtrusive. There was no grinning, no sly looks. We would be at the ballgame at Shea Stadium and for one crystallized moment there would be Fahrquar buying a hot dog at the concession stand. Or, we would be walking down Fifth Avenue and Fahrquar would suddenly appear in the crowd, walking in the opposite direction, and then just as *suddenly* vanish. Once, Jim and I were at the Metropolitan Museum of Art and for an instant that distressed-looking fellow in the sculpture "Ugoiino and His Sons" looked like Fahrquar. Then, on second glance . . . no, of course not.

Fahrquar retired a few years back and Jim and I haven't been as active in ham radio as we used to be. Jim went on to college and sort of lost his interest in the hobby. I continue to write for this magazine, but I'm not on the air nearly as much as I used to be. My job writing about the computer industry and other demands of life have kept me from operating as much as I would like. At best, I manage a couple of hours a month lately. These combined factors seem to have finally removed Fahrquar from our lives. The last apparition appeared at a New Year's party, when Jim and I thought we saw the former prez's face within the bubbles inside a glass of champagne. That may have been the result of too much good cheer, however.

The other night I slipped into my shack and fired up the old Kenwood. Slowly, I brought the tribander around on a direct north heading. The speaker crackled with QRN, and I could barely make out a QSO deep in the background. And for a moment, just a moment, I thought I heard ol' Fahrquar's call. I contemplated giving Jim a ring on the landline to tell him about it, but thought better of it. ■

Dx

Number 16 on your Feedback card

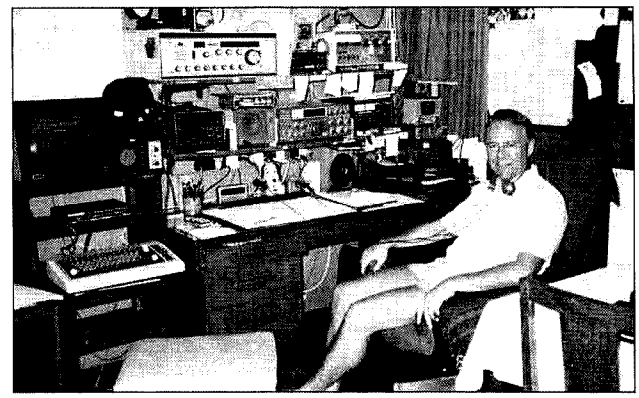
B. Gun
c/o 73 Magazine

Imagine our surprise when we opened the premier installment of our new DX column and read "Please don't give me a byline this month!" Seems our man is a bit harried and felt that there wasn't enough time to put together a "respectable" column. Heck, we gave him a week.

Of course, we'd already set aside the space for a couple of introductory paragraphs telling you how wonderful this fellow is, and what a Big Gun he is—you know, the standard bio. Now you'll have to wait until next month. If you think you're a real DX hotshot and can figure out the identity of our mystery columnist, drop a line to 73 Magazine, WGE Center, Peterborough NH 03458, Attention: DX Hotshots. We'll try to think of a suitable prize.—Eds.

On the Bands

If you hear a familiar voice signing BV, HL, or VS6 early in October, it may very well be our own W2NSD—he'll be heading east for a tour of Asia. **Chatham Island:** ZL7BKM is regularly near 14.015 or 14.210 MHz from 0200 UTC and again from 1300 UTC. **Pagalu Island** (formerly Annobon): The TR group that did such a great job as 3C0A in June and July is hoping to return there this month to satisfy the allband, all-modes requirements of those who missed their last outing. **Guyana:** 8R1Z operated by NQ4I slated for October 20–30. Rick is there for the *CQ* WW SSB contest on the 25th and 26th and will be on before and after the test on both CW and SSB, all bands but with emphasis on 75/80 and 160 meters. Europeans can look for Rick near 1827 QSX 1849 kHz during the first 10 minutes of every hour from 0200–0700 UTC. **Trinidad Island:** In honor of the 9th IARU Region 2 conference being held in Buenos Aires this month, members of Argentina's Radio Club del



Here's Phil Weaver VS6CT relaxing a bit after a vacation to the states and a mini DXpedition to KH2.

QSL ROUTES

Call	Via	Call	Via
A71AD	5B4TI	V30AA	N6ADI
C30C	F8RV	V30DX	N6ADI
C30CYA	PA3BMJ	V44KG	WB2LCH
C30LDM	DL4BBO	VE8MA	VE5FZ
C56/EA5AL	EA5EBX	VK4KA	KA5RGE
CQ0AHU	CT1AHU	VK9ZG	VK6YL
CR9XX	VS6OX	K1CLN/VP2M	K1CLN
CS0AT	W1JZ	W2JGR/VP2M	W2BIE
CT3/W2ZZ	W2ZZ	K2MFY/VP2M	K2MFY
CT4AT	W1JZ	K2OVS/VP2M	K2OVS
D68WS	DJ6QT	KD2SX/VP2M	WB2RNT
DP0GVN	DL2NF	VP2MU	W2BIE
EA8/OH8NW	OH8NW	VP5DG	KA5DGE
ED5PAD	EA5BQS	VP5Y	N6EK
EJ8CC	EI8CC	VP5Z	KC2RS
EK1AO	UZ1OWA	VQ9RN	G3WAO
EL7/EL8E	GM4LDU	VQ9ZZ	N4GNR
EO2QGL	UQ1GWF	VR6AT	G4RUL
ER3A	UZ3AZO	VR6YL	W6HS
EU3P	UP1BWW	K5KG/VS6	K5TU
FM4DS	F6FMU	K9EL/VS6	K9EL
FM5DS	F6FMU	WP4G	KP4FH
FO8AS	N5DD	XT2BR	F6FNU
FO0WR	N6VO	XT2BS	F6FNU
FS/K2IBW	K2IBW	XX9CW	DK7PE
H44BL	SM6APQ	XX9WS	JA1WSD
HA5KDB	HA7SU	YJ0ABS	DL2GAC
HA5KDQ	HA7SU	YT3W	YU3FOP
HA5KDX	HA7SU	YT4I	YU4EBL
HB0/DA1WA	DJ0LC	YW1J	YV1EJU
HC1BW	KT1N	YZ7AA	YU7MAY
HG5A	HA7SU	Z21EV	W3HNK
HG8UOT	HA5KDB	ZC4EE	IK8DYD
HG40A	HA7SU	ZF1MM	VE5RA
HL9IE	F6FNU	ZF2AH	WA6VNR
HL9OB	N4GNR	ZF2CD	W3ODJ
HU1DX	WA0JYJ	ZK1XE	WB6GFJ
HV1CN	I0CPY	ZK1XM	KB1CM
IO9AF	IT9AF	ZK1XV	VK2BCH
J3ABP	K5TU	ZL7BKM	ZL2HE
JA1YWX/JD1	JA1YWX	ZS25TUK	ZS6BCR
JR2FOE/JD1	JA4FWM	ZV2BW	PT2ADV
JW8FG	LA8FG	ZV2KT	PT2ADV
JY9RL	WA6POZ	ZV5KT	PY2KT
AI6V/KH6	AI6V	3C0A	TR0A
KB1CM/KH8	KB1CM	3D2DD	N5RM
KB1HM/KJ6	KB1HM	3X4/LA2EX	N4CID
KR7Q/KX6	KR7Q	4A1HC/4A2	AA5B
OA1A/KP2	K5TVC	4M5J	YV3EJA
K5KG/OH0	K5TU	4N1ARU	YU4FRS
K5KG/OJ0	K5TU	4N2AA	YU2ADE
OH0MD/OJ0	OH2BH	4N3KV	YU3JS
OY1R	W2KF	4V2C	WI4K
OY5NS	W3HNK	4W1NN	OE9SLH
P43SF	PJ3SF	4X8T	N4GNR
PA6VHS	PA0DIN	5B4/SM6JZ	SK6EI
HB9TL/PJ4	HB9TL	5H3ZR	SM3LDB
PP8ZAT	KC8YN	5J1LHI	HK1AMW
PY0FE	PY1BVY	5J1LR	HK1QQ
PZ5JR/P27	K3BYV	5N8BAV	I2ZGC
ST2SA	DJ9ZB	5R8AL	WA4VDE
TI1A	TI2CCO	5W1FR	KB1CM
TJ1CH	F6FNU	6W6NJ	N5GAP
TK4HC	F6FNU	7J1ACH	NG7X
TK5EL	F6FNU	8P9AK	AK6T
TL8HZ	PA0ZBL	8R1Z	NQ4I
TP2CE	F6EYS	9H3DX	DF2UU
TU2JT	F6CXV	9Q5CT	AK1E
TV3BZ	F6CRT	9X5VA	W2PPG
UF7FWW	UF6FFF	9Y4E	WA4WTG
UP9A	UP1BZZ	9Y4F	W3HNK
V3DX	N6ADI	9Y4VE	VE3CGO

100% QSL RETURNS

Here are a few tips that are the result of my checking into the gripes of many so-called DXers who, after complaining bitterly about their failure to get QSL responses, were found to have improperly executed their cards or had failed to provide return postage.

The Card

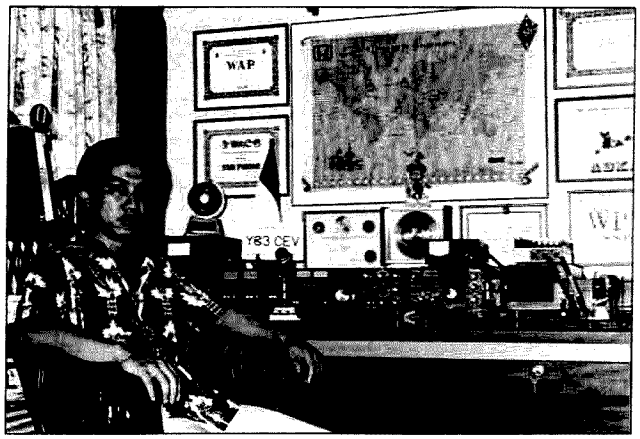
Your QSL card should have all of the QSO information and *your* callsign on the same side. If they are not printed that way, write your call conspicuously on the side with all of the information.

It is essential that you double-check your log when entering the date, time (in UTC!), band, and so on. Many "not in the log" replies are the result of errors on the card and the use of local time rather than UTC.

The Procedure

Unless you are QSLing via a bureau, *always* furnish an SASE or an SAE with either IRCs or a dollar bill ("green stamp") to cover return postage. Check the *Callbook* for a list of the number of IRCs required for each country.

The majority of QSL cards are 3-1/2" x 5-1/2" and fit nicely into a 4" x 6" envelope. However, many foreign cards are larger, so you should send a 5" x 7" SAE when QSLing an overseas station. Prepare your mailing like this: Fold the SAE in half and insert it, fold down, in your envelope. If you are including a dollar bill, wrap it in a sheet of carbon paper, fold it in half, and place it in the fold of your SAE (not in it). Tuck IRCs and your QSL card into the fold of the SAE, seal it up, and start filling out your DXCC application.



Yan Bambang YB3CEV at the operating position of his station in Surabaya in Indonesia.



Five of the ops at BY1QH, all of them engineering students at Quing Hau University. Left to right: Chang, Station Master Yuan, Liou, Qu, and Wang. The caps were donated by the W7PHO Family Hour net.

Plata will activate for the first time Trinidad Island from October 20–25. The island is in the Atlantic, 31 miles south of Bahia Blanca. The club has filed a request that Trinidad be added to the IOTA Award list and that their DXpedition be considered the official start date for IOTA accreditation. Look for AZ1D on (CW) 3.510, 7.005, 14.020, 21.020, 28.020; (SSB) 3.690, 7.090, 14.200, 21.300, and 28.600. On VHF, the frequencies will be 50.110, 146.52, and 144.300 MHz. QSLs go to LU2DT.

OH1RY will be on a South Sea Island DXpedition this month: Look for him signing /3D2 on Fiji October 19–22, /T2 on Tuvalu October 22–29 (during the *CQ* WW SSB test), /A35 from Tonga between October 29 and November 5, and /5W1 on Western Samoa from the 5th to the 9th of November. QSL to his home address.

The Bulgarian Federation of Radio Amateurs is celebrating the 60th anniversary of the founding of the first Bulgarian radio club with a special award. To qualify, earn 60 points during July 15th to December 31st, 1986, by contacting LZ6 stations (6 points each) or other LZ stations (1 point each). The award is free; send your logs to BFRA, PO Box 830, 1000 Sofia, Bulgaria.

Our French correspondents are expressing optimism in the assignment of at least one amateur in each of the crews that are now being readied for immediate departure to Crozet and also next month's voyages to Kerguelen and Amsterdam Island. Jim and Kirsti Smith (VK9NS and VK9NL) are assessing new (and apparently less rigorous!) opportunities for another DXpedition to Heard Island in early 1987. ■

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the December '86 issue must be in our hands by October 1st. Mail to *73 Amateur Radio*, WGE Center, Peterborough, NH 03458. ATTN: Hope Currier.

PROPAGATION

Number 23 on your Feedback card

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

The first part of the month will be more unsettled than the last part. Expect an unsettled geomagnetic field through the 5th and again around the 15th. The 20th–21st could also have an active field. Barring development of a coronal hole, you can expect good fall DX propagation, particularly around contest time.

OCTOBER

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F–P	2 F–P	3 P	4 F
5 F	6 F	7 F	8 F–G	9 G	10 G	11 G
12 G	13 G–F	14 F	15 F–G	16 G	17 G	18 G–F
19 F–P	20 P	21 P–F	22 F–G	23 G	24 G	25 G
26 G	27 G	28 G	29 G	30 G	31 G	

Nov. 1986
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73 Amateur Radio

Issue #314
A WGE Publication

Will my wife kill me if I buy this?

Free Energy: Is It For Real? p. 42



BUYING GUIDE p.54

Sure Cure For RFI p. 32

Easy C-64 RTTY p. 34

Circuits From Garbage! p. 30

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Step into the middle of a raging debate—can we get energy from nothing? W6HDM 42
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Figure out what frequency everyone is using for subaudible access on their repeaters. Endorsed by the Radio Police. KE6VK 48
A Pedal-Pushing Power Plant
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NEVER SAY DIE

Number 20 on your Feedback card



The following, which is in extraordinarily bad taste, should not be read by Extra-class hams—or anyone planning to be an Extra.

KILLER EXTRAS

When the word got out that the Oklahoma mass murderer was an Extra-class ham, someone mentioned that the Atlanta mass murderer had also been an Extra. Hmmm.

Well, I don't think there's ever been any question about hams being crazy—it's just that we've never really figured out whether we become hams because we're crazy or amateur radio makes us crazy. Chicken or egg? We need some serious research, eh? I'll put my money on Morse code as the unbalancing factor. All those dits and dahs could easily flip one out.

Hey, don't get mad at me for breaking the bad news that you're crazy. Crazy is just like alcoholism, smoking, and other insanities—the absolute last one to recognize there's a problem is the crazy. Look, if you think I'm exaggerating just ask any non-ham friend whom you really trust and see if he or she doesn't agree with me that you're crazy.

How else can you explain someone sitting for a lifetime trying to collect QSLs from 325 countries? There's no way to explain that as sane. And how about those of us who talk ourselves hoarse for 33 hours on a weekend trying for a dumb contest certificate? Let's see you come up with a rational explanation for ham contests. Can you explain traffic handling with a straight face? And the loonies bouncing signals off the moon?

Hams get mad when I point out that the CBers who've been arrested and put in prison for using bad language over the air over long periods of time have all been Extra-class hams. How sure are you that it isn't the 20 words-per-minute code test which does it? How else can you explain all of the really outstandingly crazy hams being Extra class? Hey, I'm sure glad I didn't get my Extra! If I'd gotten it I'll bet I'd be out there getting even with some of the people who've done me in the most in life—instead of waiting until the next life to come back and haunt the hell out of them. I intend to come back with a vengeance—none of this wimpy forgive and forget, no sir.

And those who've gone out of their way to screw me and have had the bad grace to die—I'll get those bastards when I get there. Watch out Jim Fisk. Watch out Clay Pool. Watch out Budlong. And watch out you who have swiped my more treasured possessions. Watch out all you who have it coming—and you know who you are.

Hey, what with time being different in the next world, I may even be able to get started on readers who have let their *73* subscriptions lapse—ARRL directors who have bad-mouthed me in their talks—advertisers who haven't supported *73*. I'll be real busy, but it'll be fun.

A recent *W5YI Report* went on at length with interviews of good ham buddies of N5PS—all telling what a great chap he was. Some of you must know someone good at seances, so how about getting a QSO with Pat and see what he's got to say about the mess he made. Let's hear from N5PS direct and see what he's got to say about this Peeping Tom stuff in the magazines. Hey, I've peeped a couple

Continued on page 10



"Sorry to hear about your line noise! We're rerouting our power lines seven miles to the west!"

QRM

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QRX . . .

EDITED BY PERRY DONHAM KW1O

Number 25 on your Feedback card

Antennas Away

THIS FROM OUR "Talk About A Nice Guy" department: **Ralph Janninl KA1FAA** of **Unadilla/Reyco** dropped us a note describing his company's new antenna give-away program. To encourage established ham radio clubs to sponsor radio clubs in schools, Unadilla will give *new* school clubs a Unadilla 40/80m antenna kit. To qualify, just have your school principal and the president of the sponsoring radio club drop a note to Ralph describing what's going on. There is a catch—the offer is limited to only five new clubs per state per year. You can get in touch with Ralph at Unadilla/Reyco/Inline, PO Box 215BV, Andover MA 01810-0814.

Big Pitch

WE THOUGHT that Unadilla's idea was so good that we came up with our own little pitch. We'd like to see ham radio magazines in every school library in the country (note: that's ham-radio magazines, not *Ham Radio* magazines!), so we've set up a way for you to sponsor a school subscription. For $15 a year—about 4¢ a day—you can be the one who gets the kids in your local school excited about amateur radio. At $15 we're not making any money, but amateur radio could be picking up another youngster. Well worth it, don't you think? To get this going, send us the name and address of the school library you'd like to sponsor. We'll get their subscription going and send them a letter pointing out your generosity. We'll also publish your name right here in QRX as our way of publicly thanking you for your support of your hobby. Send your info to *73* Magazine, Editorial Offices, WGE Center, Peterborough NH 03458.

Camp Kids

OK, WE'RE ON A ROLL with this kid stuff, so let me tell you about a group of hams who got together up at the YMCA's Camp Manito-wish in Wisconsin. Their ninety-minute presentation covered the highlights of our hobby, starting with a quick overview of ham radio history by **Don Kupferschmidt KD9PT**. Don also touched on our new volunteer licensing program and the differences between CB and ham radio. **Jay Van Der Burgt KA9MSR** jumped in next to help demonstrate various modes of operation, with CW demonstrated by **Mike Kurtz AA9Y** and SSB shown by **Jack Peterson KC9NE**. KJ4R and KA9ODM helped out by operating from their homes a few miles away (an exceptionally good idea . . . nothing's worse than standing in front of 100 fidgeting kids calling endless CQs, praying for someone, *anyone* to please, please come back to you!). More quick demos followed with Don describing VHF and repeaters, and packet radio. Finally, a question-and-answer period wrung out the adults with those difficult queries that come only from eager young minds. The point of all this is that taking ham radio to the kids is a heck of a lot of fun, isn't hard to do, and plants that little seed in their minds that, "Hey, isn't this neat? I could do that!" Be sure to send your stories to QRX so everyone can get ideas on how to do this sort of thing.

Calling Canada

WE HAVEN'T HEARD MUCH from our neighbors to the north recently, but rumor has it that the Department of Communications (DOC) is letting hams up there pick their own callsigns. (You have to wonder when things up there get quiet—Garrison Keillor of *A Prairie Home Companion* claims that the Canadians are plotting to invade the U.S. "You just can't trust them," he says. "They're too quiet.") **Bill Leal VE3ACY**, president of the Windsor Amateur Radio Club, mentions in *Ground Waves* that the DOC has everything all set up on a computer, and you tell them what call you want and they just give it to you. He changed from VE3IHB (I can see why!). On our side of the line, it looks as if the FCC will be letting us do about the same thing in the very near future. The FCC will still issue the "official" callsign, but you'll be able to buy any call that you like and use that one on the air. The Feds will have a cross-index of who has what, so they can still nail you with a pink slip if you screw up. Things are in the rough planning stage as this is being written, but when it all firms up we'll have all the details. (I certainly wouldn't mind getting rid of KW1O. Yechh. Wayne says he would pay big money for the call he wants: "W.")

Book Nook

HERE'S YOUR CHANCE to pick up Christmas gifts for everyone you can think of! *73* is back in books; we're kicking things off with two classics: ***The Contest Cookbook*** by Bill Zachary N6OP and ***The Magic of Ham Radio*** by Jerrold Swank W8HXR. The *Cookbook* covers every aspect of amateur contesting, from station layout to equipment to techniques. Separate chapters are devoted to domestic, DX, and VHF contests. This book includes tips from winners on how *you* can be a contender! 170 pages. $5.95. Jerrold Swank's *Magic of Ham Radio* is filled with the excitement of amateur radio—stories of daring rescues and life-saving communication. This is a book you'll want to give to your friends when you want them to become interested in ham radio! 156 pages, $4.95. Send your order to *73* Books, WGE Center, Peterborough NH 03458. Please add $1 to your order for postage.



Hamming it up at Camp Manito-wish. Photo by KC9NE.

Chip Tip

CHUCK HOUGHTON WB6IGP say that some folks are having trouble getting the TDA-7000 chip for his i-f amplifier ("Microwave Building Blocks: The I-f Amplifier," October, 1986, page 42). Chucks says that he has picked up a gross and will sell both the TDA-7000 and the printed-circuit board for the project for $10 postpaid. Get in touch with him at 6345 Badger Lake Road, San Diego CA 92119.

MARC Mark

THE MICHIGAN AREA REPEATER COUNCIL has overwhelmingly voted to move directly to a 20-kHz band plan in the state. Existing repeaters have all been included in the new coordination scheme, although a few sites have some problems. MARC officials expect to have everything resolved and all repeaters in Michigan on the 20-kHz plan by year's end. The council also has elected new officers: **Rod Moag W8NDS** takes over as Chairman, **Jim Brooker NI8E** steps in as Vice-Chairman, and **Paul Englehart KA8BFF** keeps his post as Secretary.

ATIS Onus

THE FCC is looking at a proposal (GR Docket 86-337) that would require an automatic identification of all satellite uplink signals. The system, cleverly called the **Automatic Transmitter Identification System (ATIS)**, would help track down interference in the satellite service, whether it is deliberate or accidental. A unique identification code would be imbedded in every transmitter at the time it was manufactured. Vigilantes like Florida ham Captain Midnight are fairly rare, but it is common for technicians to aim portable uplink dishes at the wrong satellite. ATIS would allow for instant identification of the culprit. Of course, a true hacker out to ax a bird would not worry at all about ATIS . . . he would find some way

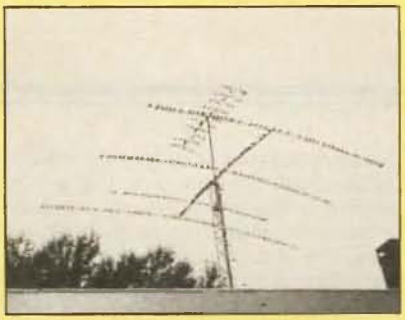
around it. What interests hams about 86-337 is that the FCC is also asking whether *all* radio transmitters should be equipped with ATIS; that includes ham gear. Hmm . . . maybe we could do away with callsigns altogether.

Still III

THINGS LOOK GRIM for our old friend AMSAT-OSCAR 10. Efforts to write a program that could work around damaged areas in memory appeared at first to be successful, but in the past few weeks more problems have surfaced that spell the end of AO-10. The satellite is operating right now in an unpredictable manner; you never know what mode is going to be on when. The mode-B transponder is stuck on, and AMSAT ground controllers have been allowing limited mode-B operation during part of each orbit. AO-10 will be moving into an eclipse period very soon, and unless something drastic happens to perk the bird up, it will not receive solar energy to charge the batteries. There is currently no way to adjust the satellite's sun angle to compensate for the diminished sunlight—once the batteries are dead, AO-10 will be silent.

Contest Code

FREE SOFTWARE is available from **Bill McClellan KV0I** for Commodore C-64 or C-128 owners who plan to operate in the 1987 *73* World SSB Championships. The program is a logger for the contest, and features a fast machine-language duper/sorter, real-time scorekeeping, and hard copy of logs. (We'll be printing the rules for the Championships next month, along with the results of this year's test.) If you would like a copy of the program, send a self-addressed, stamped disk mailer (SASDM?) to Bill at 3304 Jo Ann Avenue, Omaha NE 68123.



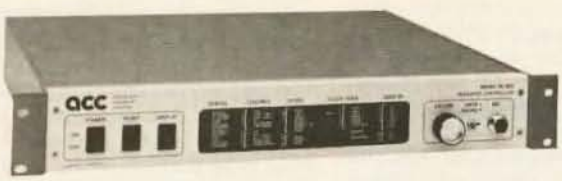
"Seems this fellow was hearing a few birdies in his receiver. . . ." Photo by WØRIM.

Fuji OK

AMATEUR RADIO'S newest satellite was launched after a few delays on August 12th. The bird has worn three names, starting life as JAS-1, changing to OSCAR 12 after launch, and now rededicated **Fuji-OSCAR 12 (FO-12)**. Japanese spacecraft are christened with a flower's name when they start operation in space; Fuji is the Japanese word for wisteria. Early users report that FO-12 is very sensitive, easily accessed with only 100 Watts erp. Mode-JA uplink is from 145.900 to 146.000 MHz, with the downlink falling at 435.900 to 435.800 MHz. The transponder inverts uplink signals: To calculate a downlink frequency, subtract the uplink frequency from 581.800. The beacon is at 435.797. JARL recommends that CW be used in the lower third of the passband (435.800–435.835 MHz), with SSB in the upper third (435.865–435.900 MHz) and mixed CW/SSB in the middle third. The digital transponder, mode JTD, is currently being tested and should be running by the time you read this. For tracking information, get in touch with AMSAT at PO Box 27, Washington DC 20044.

Done

That's a wrap for this issue. We had input from *The W5YI Report*, *Amateur Satellite Report*, *The Westlink Report*, and John Hackman WB4VVA. We're always looking for fun stuff to run; send your news to *73* Magazine, WGE Center, Peterborough NH 03458, Attention QRX. Slip a twenty in the envelope if you *really* want your item published (just kidding, Wayne . . .). Oh, you can also send things via CompuServe at 70310,775, or via MCI Mail at WGEPUB.



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NEVER SAY DIE

from page 4

times—I just haven't passed my 20-wpm test.

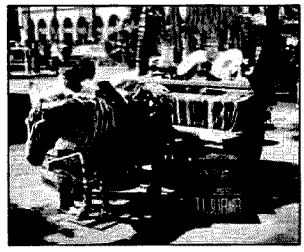
Yep, I peeped. Well, I have to tell you it was fun. That was back when I was 12 and in the Boy Scouts. After patrol meetings our group would go out and peep in ground floor apartment windows. The head peeper patrol leader would gasp in amazement, naturally driving the rest of us to peek. We'd gasp too. The fact is I never saw anything. But education is what the Boy Scouts is for, isn't it? And what better sex education than a good peep at the right time. It's just our timing was bad.

Now this camouflaged suit business is a real tipoff. Something extra has to be wrong with people who wear camouflaged T-shirts—sox—hats, and that nonsense. You show me an Extra-class ham in a camouflage suit and I'll show you some real running speed. Where's my bullet-proof vest—the one I wear to ARRL conventions?

I say let's stop this carnage. Let's petition the FCC to stop the 20-wpm code test before it's too late and we drive more innocent hams over the edge.

SAN DIEGO

The ARRL National Convention this year was in San Diego in early September. Though there weren't many exhibitors, the event sure brought out the local hams—very good attendance. I heard some estimates of 5,000. This is surprising for California. The weather couldn't have been better.



To celebrate W2NSD's visit to Tijuana during the ARRL National Convention, every donkey in the city was painted to look like a zebra.

Since I got on the speaker's list late, all they had left open was Sunday morning—sure death for a speaker. Well, the room wasn't packed as usual, but an estimated 300 turned out—astounding for Sunday morning. Even more so when you know the hamfest only ran from 9 to 12 on Sunday and my talk was from 10 to 12!

One of the problems with talking at such a difficult time is that I find I'm preaching mostly to the converted—the hard-core Wayne Green fans. If we're going to get amateur radio growing, I've got to get more hams to read *73*—so I need to reach the Wayne Green haters—and, even more, the apathetic, many of whom don't read *73* and haven't even heard of me.

Maybe you have some ideas on how I can get more hams to read *73*. Unless a lot of readers are lying to me, I've perked up the magazine so it's fun to read again—more fun than any other ham magazine—which, alas, isn't very difficult. When I send letters to the *Callbook* list I find that about 98% of the hams just throw my letters away. I don't even know if they open them. Talk about depressing! So maybe you have some ideas?

Look, if you want to get a 300-page magazine every month—packed with construction articles, hot news on packet, international news, and so on, it's going to take 120 pages of advertising. That's a fact of publishing life. And that doesn't put me on easy street, that's just in order to break even.

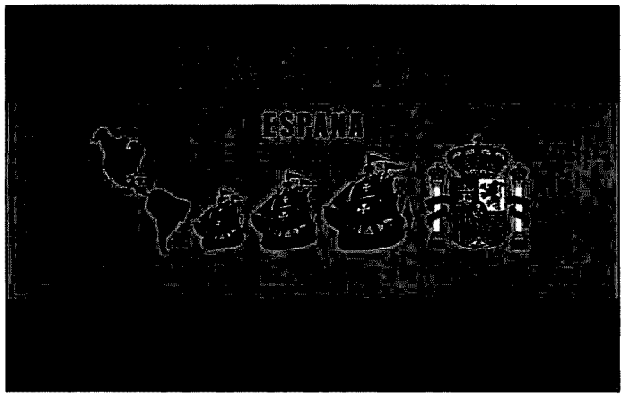
Now, how do we get 120 pages of ads the way we used to a few years ago? First we have to have about 120,000 paid readers. The rule of thumb is that a magazine should be able to sell about one page of ads for every thousand readers. So if we can double the number of *73* subscribers, I think we'll be able to turn out some 300-page magazines for you and make *73* as exciting as it was around five and ten years ago.

So what do you suggest I do to get your friends to subscribe? It'll help if you try not to keep a total secret of how much you enjoy the magazine now. It won't hurt if you bring up the matter of getting club members to subscribe at club meetings. I even have some attractive group subscription deals for clubs.

Just having 120,000 readers won't magically get us 120 pages of ads. I'm going to need a good deal of help here, too. Many firms are so brainwashed about *QST* that they'll go out of business never even trying their ads somewhere else to see if they'll bring more sales and save their companies. You can help here by beard-ing them at hamfests and telling 'em you're looking for their ads in *73*. If you happen to correspond with them about something, mention it.

73 has the most lively bunch of ham readers of any ham magazine—our advertisers constantly tell us their ads pull sales much better from *73* than anywhere else—yet even though it's costing 'em thousands of dollars in sales—cash money out of pocket—I see many ham firms not even giving us a chance to show how we can build their business.

The advertisers put a lot of store in the Reader Service requests we



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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pass along to them, so make sure you send for information on any product in which you're interested. They also have to make sales in order to stay in business, so don't jerk them around.

If you get to any of the major hamfests, you know that the bulk of the firms selling products to hams are small and run by hams. Indeed, no one else would bother to try to survive in such a dying market. In the past, a large part of the sales of ham gear was to newcomers. These days, with newcomers dropping more and more every year, much of those sales are gone. That leaves us with a relatively small group of active hams—plus a raft of semi-active—the hams who have been rag-chewing for years with the same old gear—talking with the same people year after year.

DXers and contesters have to keep more up to date or else they fall behind. We're seeing most of the top DXers and contest hams using the newest computer-controlled rigs—putting up newer and better antennas every couple years—using a computer for log and record keeping.

The chap in the booth next to *73* had a corking good program for working the Sweepstakes contest—a contest I always used to enjoy. It keeps track of every contact, checks for duplicates, let's you know what sections have been worked and which are still needed, and so on. It sure would have made my contesting a lot easier to have an aid like that at hand!



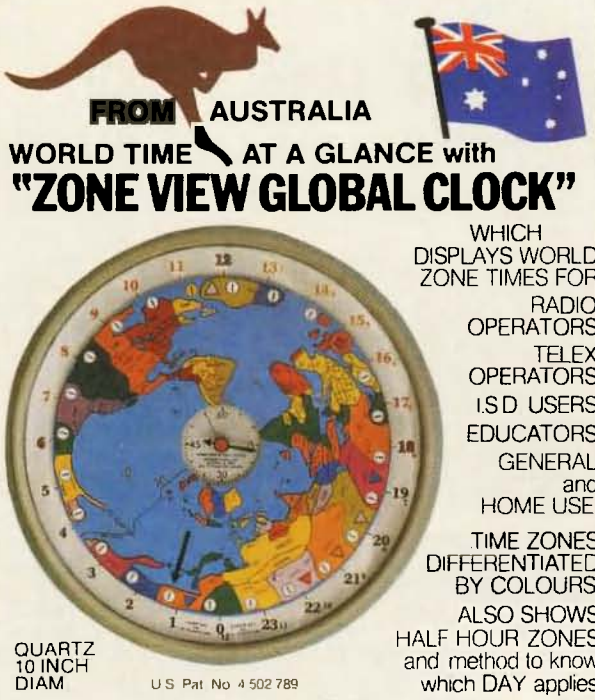
W2NSD/ZF groping for grouper in Cayman Brac.

Speaking of contests, it's getting on time for someone with contest experience to write some instructions on how to win contests. Contests are won, for the most part, by hams who thoroughly believe that winning isn't just important—winning is everything. So I'd like to see helpful hints on winning contests—like how to leave openings in your log for the later insertion of normal-looking mythical stations from missing sections or countries. After all, the contest log checkers can't verify everything, right? So if you put in some calls you know, but which you didn't hear during the contest, who's to know? It's despicable to win a contest certificate by such scurrilous skulduggery, but unless we let everyone know the contemptible techniques used by some of the high scorers who seem to have forgotten that amateur radio is a hobby—for fun—they'll be at a serious disadvantage. Only by bringing such treachery out in the open can it be thwarted, so let's have some facts on how some conscienceless hams have been screwing their more honest fellow hams.

One of the more fun aspects of the hamfest was the hospitality suites after the show closed. The 10-GHz group outdid everyone else with a bluegrass band—Gerry Earl N6LYX lead guitar and singer. Of course I'm a sucker for bluegrass music anyway. I've been increasingly upset that no bluegrass has yet come out on CD (at least that I know about). I wonder how many ham bluegrass groups there are out there? I'd sure like to find one in each city where there's a major hamfest so I could organize a hospitality room, complete with a small band.

My good friend Chuck Martin WA1KPS, who used to run Tuft's Electronics, plays a mean blue-





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grass guitar. It made the drive from Denver to Aspen go quickly as we sang our way across the mountains on our yearly ham industry skiing trip there. I think we'll be hitting Aspen again this January—HTs tying us together as we ski the different areas.

I wish a group in San Diego would get a yearly hamfest started so it could build up attendance. You don't get a big pull the first year or two—these things have to build up.

San Diego isn't far from L.A.—has perfect weather—it could do well as a yearly hamfest site. It's got plenty of interesting things to see—such as Old Town, Tiajuana, and the famous San Diego Zoo. Let's do it again.

The Las Vegas hamfest in November looks as if it will be a yearly affair, so I'm rooting for it. The chap running it has lots of good ideas and needs all the cooperation he can get. The old Saroc hamfest built up for a while, but then was killed off by what I saw as extraordinarily poor management. I know I got lied to and shafted—and I heard from others with similar problems.

By having the hamfest just before Comdex, it should pull in not only those California hams who enjoy a couple of days in Vegas, but get the computer industry hams to come a couple days early—and there are a whole lot of hams in the computer business.

THROW YOURSELF INTO THE VOLCANO

It's getting time for some human sacrifices if we're going to save amateur radio. It's a drought and the crops are dying. How about you—are you willing to sacrifice to help stop the bleeding?

A letter from Ed WB6IDP had a good suggestion. One of the reasons we're losing more and more hams every year is that such a high percentage of Novices aren't making it to Tech or General. If we could improve the percentage of Novices who stay with us, we might at least break even and stop falling behind.

If we can get Novices to increase their interest in amateur radio, we stand a very good chance they'll infect some of their friends with their enthusiasm and help us get more Novices. This goes particularly for the 15% of the newcomers who are teenagers—the ones we need most to reach.

Okay, how can we get Novices to stick around? Well, one simple way is to make sure they find amateur radio fun. Novel thought, eh? Now let's have a show of hands—how many of you have worked a Novice in the last two months? Humph, I thought so. You're so damned busy rag-chewing you haven't any time to try and make life more fun for Novices. What the devil do I have to do, start a contest and give certificates to bribe you to do your civic duty and put in some time with your key and help our Novices have some fun?

Let's be honest about this now . . . you're probably going to have to do some code practice to get your speed up to five per so the Novices won't embarrass you. If I had it my way every ham who insists on our keeping the code test would have to be tested every year at a minimum of 35 wpm. So get out your code tapes and spend a few weeks getting your speed up to 5 wpm and then get on one of the Novice bands and be nice. None of this QLF crap, okay? I can't tell a D from a TI when you send it, you know. Bad when you have the DTs. Let me know how long it takes you to figure that one out.

Rather than tell the poor Novice about that old rig you're using, I suggest you look up one of the modern ones in *73* and just tell 'em you're using one of those. After all, the chances are your rig was made before the Novice was born and he's never heard of it. Once the ARRL gets their new $6 million museum up and running, Novices may get to be more familiar with your gear.

I'll bet you thought I was going to be critical of the League for putting so much into a museum instead of investing it in promoting the growth of the hobby. Nope, not me. I think they see amateur radio about to crash in the near future, so the best possible investment will be a museum so later generations will be able to know there once was something called amateur radio. Good move. I've got some first-class stuff I might donate . . . been wondering what to do with it.

I can hear the consternation now as Extra-class ops ask each other where the Novice bands are. Anyone got a *Callbook*? Maybe there's a frequency chart in there. How about the *Handbook*? Hmmm, I wonder if my 1955 edition is still okay to use? I don't see any point in buying the damned things every year.

Continued on page 62

LETTERS

Number 18 on your Feedback card

THE FIRST

J. L. Reinhartz did not originate the feedback circuit shown on page 68 of your September issue ("Kit Corner: Build a Two-Tube Receiver"). The first article covering the use of a fixed "tickler" for feedback and a variable capacitor for ease of control was the lead article in the December, 1919, *QST*. The author was "Donald F. Alexander, radio 1BK." I had just received license 1BK on October 1, 1919, but had been building receivers for two years.

The editorial box at the top of the article said, "This article is a description of a tickler-feedback set, and is destined, we believe, to be popular.... Receivers containing variometers are difficult of construction in the home workshop. Mr. Alexander's set is a cinch...."

My mother once told me of my father, "Son, your father has now an incurable disease...it is called the plague of total recall." So forgive me, too.

Don F. Alexander W8LK
Dayton OH

Forgiven. And, unfortunately, forgotten.—KW1O.

OUT OF TOUCH

In response to the August, 1986, Letter "AM-ATEUR RADIO":

Writers submit AM articles only to publishers interested in publishing AM articles; therefore you never see any at *73*. If you never read any then it must be by choice because there are plenty out there.

Ever wonder why new transceivers have an AM mode? Is it because manufacturers are out of touch, or could it be that publishers are out of touch?

W6RNC is not stuck in the hobby of 40 years ago as you stated. He is 10-20 years ahead of his time. And don't feel sorry for W6RNC, feel sorry for yourself because you're the one missing out.

One final note. Get your equipment this year. The cost of the old gear is going up, up, up.... No one is making it any more, and once it's gone it's gone forever.

Art Rideout WA6IPD
Fallbrook CA

There seems to be a problem here. We don't publish AM articles because we don't get any; you don't send any in because we don't publish them. Believe me, 73 will survive a lot longer without AM articles than AM will without articles in 73. So the burden is on you and the AM community to come up with some interesting projects to send in—and I promise you that 73 will publish any article we think is worth reading...even if it's about AM.—KW1O.

FUNNY PAPERS

For years now I've been trying to promote ham radio to the younger generation; I just keep failing. Let's face it, the Japanese influx of computer games, cheap computers, and chicken band gear is hard to compete with. I sometimes think that the Japanese obsession with monster movies some years back was prophetic...they're likely to become the monster that ate the world.

Kids are highly impatient—they want it now. Kids aren't going to plunk down $300 for some used gear if they don't have any interest. To generate this interest, they need the rig. Catch 22.

Young minds are innovative. If you can spark their interest, they soon find ways to get the money for bigger and better things. Home-brewing tends to foster basic skills and insights that appliance operators never will develop. I have known graduate engineers in our electronics industry who didn't know how to solder. This is how the Japanese got the ball from us and are running with it. Newington's answer to all this is a comic book. It is comic in more ways than one. The best it can hope to do is generate more appliance operators.

George Hermann N9BNH
Chicago IL

George, I agree with you that home-brewing is a great way to develop electronic savvy. However, we're looking at a hobby that's changing...and holding on to the "old ways" just won't cut it anymore. There's nothing wrong with being an appliance operator; after all, the goal of ham radio is to communicate, not to sit around building transceivers. Giving Novices voice privileges is a good first step. Now let's push to drop the code requirement from the Novice license and really *start communicating!—KW1Q.*

DOWNHILL

I believe that a high priority in the program to get amateur radio growing should be to prevail on the FCC to not discriminate against our young people, presently licensed as Novices or planning to become hams, in not allowing A3E in the proposed new "enhanced" Novice 10-meter phone band. I would like to remind the people at the ARRL who proposed this that this hobby of ours would not have grown as it did without a mass migration of us old-timers to 160-meter phone (AM) operation in the early 30s.

The reason the hobby is going downhill today is that our ham magazines no longer publish articles on how to build your own simple gear for a first station setup. The big bucks cost of the rigs presently advertised is out of reach for the majority of young people who might consider sweating out the Novice license requirements. With availability of the information and parts to build one's own gear, these people would be interested in becoming hams. The problem here is to turn around the present situation so local parts suppliers can get back into business to supply this group of prospective hams.

Irving Megeff KD2EF
Flushing NY

The cost of ham equipment is about the same as that of a stereo, or a home computer, or a dirt bike. Price is not the problem. Showing kids how to build a station out of a scrap TV won't help, either—at best they'll get a QRP transmitter that barely gets out of the yard and a junky super-het receiver to match. Big deal. What we need is to get kids talking to each other, and that means starting up clubs in every school in the country. That's *our high-priority program.—KW1O.*

OLD FRIENDS

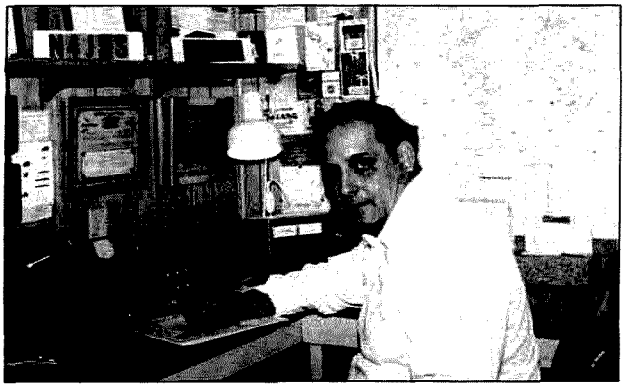
Wayne: Here's a note to bring back some memories of your visit to Aqaba, Jordan.

Our family met your family during one of your many trips overseas. It was my pleasure that you used my rig to make some QSOs from our QTH. I really wished you could have stayed longer, as there were a million questions I thought of asking...after you and your wife had gone.

Anyway, I'm back in the U.S. now, operating as N4JFS instead of the pileup-grabbing JY9CW, and I'm beginning to feel like a small pea in a very large pot—it's terrible being a has-been. How about an uplift, Wayne? It would do me wonders.

Matt Barbani N4JFS/JY9CW
Vienna VA

Of course I remember my visit to Aqaba and getting on the air from your station. And sure, I'll see if I can't get your picture in 73. That should give you some attention on the air. I had a great time at Aqaba—particularly the birthday party you took us to—and the scuba diving in the Gulf of Aqaba with HM's equipment.—Wayne.



Matt Barbani N4JFS/JY9CW.

NEW PRODUCTS

Number 21 on your Feedback card

DIAMOND SYSTEMS HAM TESTS

Diamond Systems has introduced a computerized self-testing study guide for IBM and Apple computers. Separate tests are available for each class of license. The program provides automatic random selection of questions from the appropriate question pool and keeps a running count of the total number of questions answered, the number of wrong answers, and the percentage of correct answers.

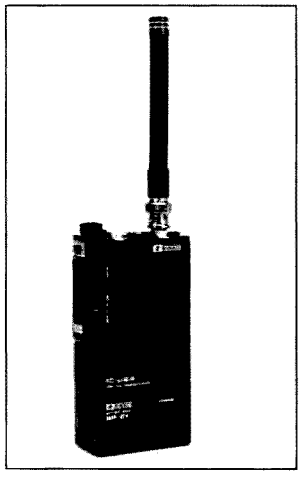
The Novice test is $24.95; all other tests are $34.95. For more information, please check Reader Service number 206.

TWO NEW ICOM HTs

ICOM has released the 220-MHz counterpart to the popular IC-02AT and IC-04AT hand-helds. The IC-03AT features coverage from 220–224.995 MHz, an LCD display, a DTMF pad, 2.5 Watts rf out, 10 memories, memory scanning, programmable scanning, and 32 built-in subaudible tones. The IC-03AT comes with an IC-BP3 rechargeable battery pack, an ac wall charger, a belt clip, and a wrist strap.

The second entry is ICOM's IC-μ2AT pocket-sized 2-meter handheld. The Micro covers 139–174 on receive, and transmits from 140–150 MHz with 1 Watt output (1.5 Watts with an optional battery pack). Other features include ten memories for storing frequency, offset, and access tone information; an LCD display on the top panel; scanning; and 32 built-in subaudible tones.

For more information, please check Reader Service number 213.



ICOM's new pocket-sized IC-μ2AT.

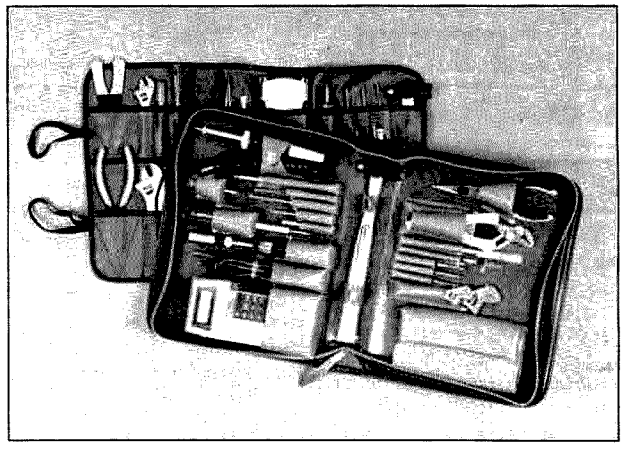
JENSEN TOOL KIT

Jensen Tools has introduced a new kit featuring tools for troubleshooting, servicing, and repairing all types of electrical and electronic equipment. Designated the JTK-84, the kit includes screwdrivers, nutdrivers, hex and spline drivers, pliers, cutters, wrenches, a hammer and punches, soldering equipment, and more. The kit is available in a vinyl zipper case or in a vinyl roll-up pouch that fits in a tool case or desk drawer.

For more details on this and other Jensen products, check Reader Service number 210.

KENWOOD R-5000

Kenwood has released information on its new R-5000 HF/VHF general-coverage receiver. The R-5000 looks similar to the TS-440S and features full coverage from 100 kHz to 30 MHz; additional coverage from 108–174 MHz can be had with the optional VC-20 converter. The receiver's 100 memory channels store frequency, mode, and antenna selection information. Other features include Kenwood's DynaMix™ system for a 102-dB dynamic range, dual digital vfo's, direct keyboard frequency entry, a built-in power supply, and dual 24-hour clocks with timers. Accessories include a voice synthesizer, a computer interface, and a variety of filters.



Jensen's JTK-84 tool kit.

For complete specifications, check Reader Service number 207.

TORONTEL SSTV SYSTEM

Torontel Technology Systems Graphics Environment for Slow-Scan Television (GEST) is an icon-oriented software package designed to marry the power of an IBM PC to Robot's 1200C color scan converter. GEST gives the SSTV operator a palette of over 250,000 colors (65,000 colors can be on the screen at any time), animation, image manipulation, image editing with over 20 functions, software signal processing and filtering, and a full 1200C control panel on the computer screen.

For complete information, check Reader Service number 208.

APE MICRO-CLEAN

Automated Production Equipment has announced a complete line of ultrasonic cleaners for the electronics industry. The A.P.E. Micro-Clean is available in sizes from 2 to 11 quarts, with prices running from $249 to $525. The cleaners are also available with custom-fitted covers, baskets, and trays.

For more information, please check Reader Service number 211.

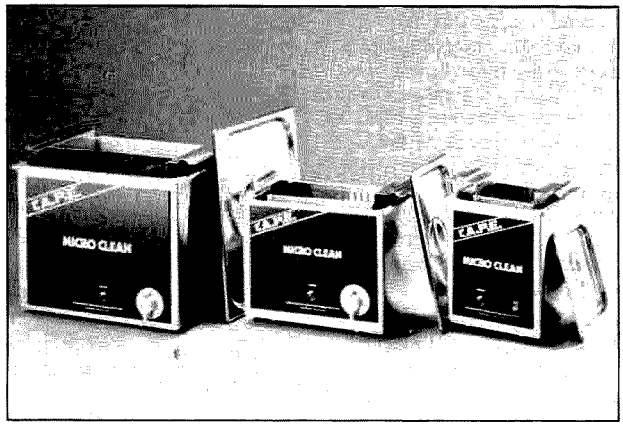
KAUL-TRONICS MESH ANTENNA

A new mesh satellite antenna, ideal for use on patios or other restricted areas, has been introduced by Kaul-Tronics. The Trans-7 is compatible with both C-band and Ku-band systems. Adaptable to either a patio mount or a polar mount, the black mesh antenna has an f/D ratio of .39 and a focal length of 33 inches. Gain is 37 dB on C-band and 43 dB on Ku-band.

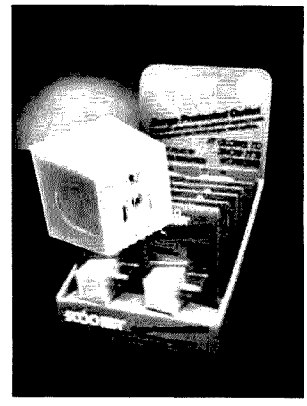
For additional information on Kaul-Tronics antennas, check Reader Service number 212.

SCOOTER SURGE PROTECTOR

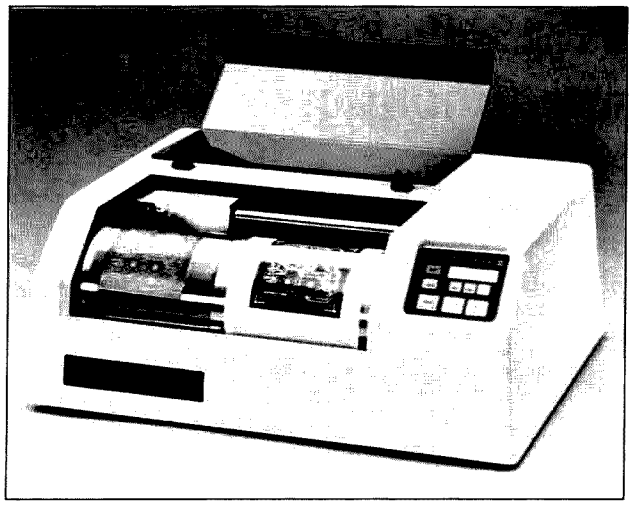
Ohm/Electronics has introduced its new Scooter™ model SP-100 Guard-It single-outlet



A.P.E. ultrasonic cleaners.



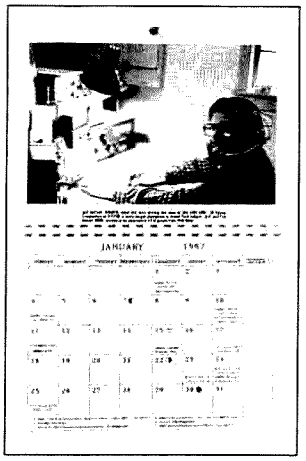
Single-outlet surge protection from Ohm/Electronics.



The Girard Protoflex-III printed-circuit system.



Free tool catalog from Jensen.



KB1T's ham radio contest calendar.

surge protector. This 125-volt, 15-Amp line-protection device plugs into any three-prong wall socket and glows to show that it's protecting your equipment against voltage surges. Use it to protect microcomputers, monitors, VCRs, radio gear, stereos, and so on.

Suggested retail price is $9.95. For more information, please check Reader Service number 214.

GIRARD PROTOFLEX-III

Girard Electronics now offers a new system for fabricating printed-circuit boards directly from CAD equipment without chemicals. The Protoflex-III model PF-IIIA works from a CAD schematic or line art (film positives or negatives, or patterns from a magazine) and can produce tin-plated copper patterns on a polyimide base at the rate of 75 square inches per hour. The flexible circuit can be laminated onto a double-sided board.

For complete information about the PF-IIIA, please check Reader Service number 209.

DAVLE TECH TOOL CASES

Davle Tech's models TC-11 and TC-15 are rugged, lightweight, vinyl-laminated aluminum tool cases featuring removable tool pallets, aluminum partitions in the bottom, soft handles internally reinforced with steel cable, and a one-year warranty. The TC-11 measures 18" x 12.75" x 5.5", while the TC-15 is 18" x 12.75" x 8". Both models are available with formed polyurethane foam, elastic pallets, or conventional pocket-type pallets.

For more information on these and other Davle-Tech products, check Reader Service number 215.

FREE TOOL CATALOG

A free catalog of tools and test equipment is available from Jensen Tools, Inc. Illustrated in full color, the 160-page catalog contains more than 1,000 items of interest to electronic service technicians, students, and electronics hobbyists.

Two new sections feature supplies and equipment for fiber optics and wire/cable systems. An expanded line of circuit board equipment includes breadboard kits, cutting tools, drill sets, insertion/extraction tools, and test cables.

For your copy of this free catalog, check Reader Service number 217.

KB1T PHOTO CALENDAR

KB1T Radio Specialties has announced availability of the 1987 Amateur Radio Photo Calendar. The 1987 edition is a 32-page spiral-bound book with two pages for each month: A 7" x 10" black-and-white photo of contest action on one page and dates and times for most of the major ham contests on the other. There's also plenty of room for jotting notes and keeping track of schedules.

The calendar is $11.95 plus $1 for shipping in the U.S.; for more information, check Reader Service number 204.

XCELITE CUTTERS

Static-dissipating sleeves, designed to control electrostatic discharges that could damage sensitive electronic components, have been added to the Xcelite® line of stainless-steel diagonal cutting pliers. Made of Benstat®, the sleeves do not contain carbon elements or other agents that particulate or slough. This makes the cutters ideal for clean-room applications.

The sleeves are available on six models of diagonal cutters (112CGSD-117CGSD); all six meet DoD standard 1686 and DoD Handbook 262 requirements for static-dissipating material.

For more details, please check Reader Service number 216.

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results and rules

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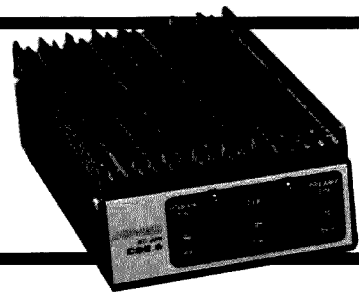
73 Review

Head to Head

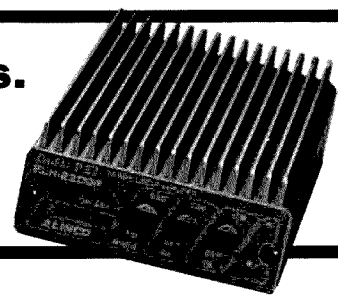
220-MHz Rf Power Amplifiers

by Peter H. Putman KT2B

MIRAGE
C22 A
Mirage/KLM, Inc.
16890 Church Street
Morgan Hill CA 95037
Price class: $105



vs.



ALINCO
ELH-220GF
Alinco Electronics, Inc.
Box 2009
Reno NV 89515
Price class: $100

Number 11 on your Feedback card

There's no doubt that what makes the 220-MHz band "tick" is the large number of FM operators, especially in metropolitan areas. 220 has become a haven from the congestion and chaos of the 2-meter band in these areas. Surprisingly, though, many operators on 220 possess no more than the bare bones—a 220 hand-held radio with 1 to 3 Watts output.

Quite often you will hear one of these operators using that same HT from his car, breaking in and out of the receiver with that same 1–3-Watt power level. After being informed that his signal just isn't cutting the mustard, the purchase of an intermediate power level amplifier is the next predictable step. For the infrequent user of 220, the investment in an HT and amplifier might total more than a 25–30-Watt mobile radio. . . but it does offer more flexibility around the station and in the car.

Who makes these amplifiers? There really isn't much of a choice! For the longest time, the only manufacturer of a 25-Watt amplifier for 220 MHz was KLM (now Mirage). The trusty Mirage C22 A (2 W in, 20 W out) has been with us for some time and is a familiar face. I've used one around the shack for about 1 year now for my 220 HTs and have also operated mobile with it on numerous occasions.

But now there's a newcomer to 220 FM. Alinco Corporation of Nevada has introduced the ELH-220GF 20-Watt amplifier with GaAs-FET preamp and rf-sensed switching, all in an attractive package about 6" x 3" x 1". It is designed to take up to 3 Watts input for as much as 30 Watts output, making it attractive as a mobile or auxiliary base-station amplifier. This also puts it in head-to-head competition with the Mirage C22 A! How do the two units compare in performance? Let's start with the Alinco.

Appearance

The case is attractively designed and the controls easy to use. From left to right, they are: MODE (SSB or FM), RX ON/OFF, and TX ON/OFF. The MODE switch selects the time constant for relay dropout between words on SSB (on FM, it is instantaneous). The other controls are self-explanatory. The rear panel uses a 2-pin connector for dc, as opposed to the Mirage C22 A which has permanently wired power leads. Two SO-239 jacks are provided for input and output connections.

The Mirage unit comes close in size, roughly 6" x 3" x 2". It also has three controls on the front—POWER ON/OFF, SSB/FM, and PREAMP ON/OFF. These function the same as their counterparts on the Alinco. Again, two standard SO-239 jacks are employed for input and output connections.

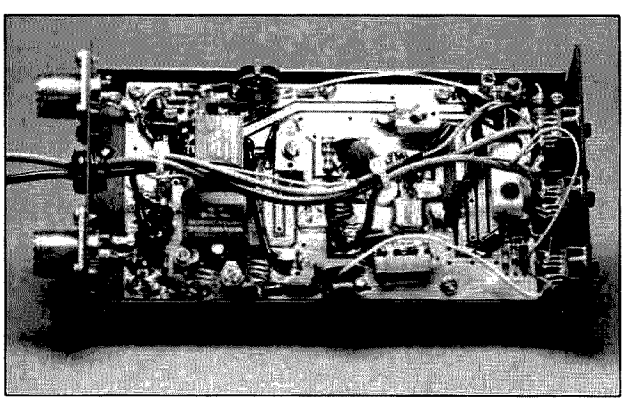
One comment worth noting here: I much prefer the conventional four-hole flange type SO-239 used on the Mirage rather than the single hole threaded type used on the Alinco. Why? Repeated connecting and disconnecting of the cables to the Alinco can cause the nut holding the connector to come loose and it might rotate in the hole. Use of the flange type connector by Mirage eliminates that possible problem.

Both units employ LED indicators to show that the receive preamp is on. The only other LED on the Mirage indicates that 13.8 V dc is present. The Alinco shows this as well but also provides LED indication when actually it is in the transmit mode. Amplifiers are frequently under a seat or in the trunk, so it's a moot point.

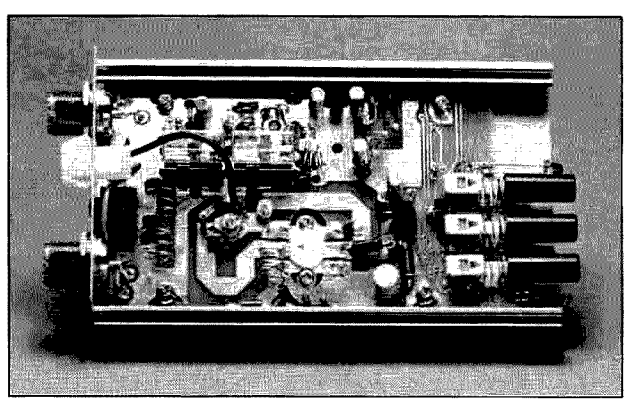
Performance Tests

Now on to the hard numbers. Both units were tested with the usual Hewlett-Packard 8640 RF Signal Generator and 8554 Spectrum Analyzer combination. Table 1 shows transmit linearity—that is, what level of output you could expect for a given input level. Both amplifiers nominally operate at about 10 dB of gain for a given input signal, and the results seem to reflect just that. The Mirage appeared to saturate at about 22 Watts output, while the Alinco reached saturation at 32 Watts output. (Final stages in each amplifier are: Mirage—MRF204A; Alinco—2SC2540.)

Both amplifiers compress (1-dB compression point) at about 2 Watts input. Gain falls off after this drive level on both amplifiers, but the Mirage falls off abruptly, while the Alinco con-



Interior view of the Mirage C22 A.



Interior view of the Alinco ELH-220GF.

Input Level	Alinco Output Power (W)	Mirage Output Power (W)
50 mW	1	1
100 mW	2	2
150 mW	2.5	3
200 mW	3	4
250 mW	4	4.5
300 mW	4.5	5.0
350 mW	5	5.5
400 mW	5.5	6
450 mW	6	6.5
500 mW	6.5	7
550 mW	7	7.5
600 mW	7.5	8
700 mW	8	9
800 mW	9	9.5
850 mW	9.5	10
950 mW	10	12.5
1 W	12	13
1.2 W	14	15
1.5 W	16	17.5
1.7 W	18	18.5
2.0 W	20	21
2.6 W	24	22
3.2 W	26	
4.0 W	28	
5.5 W	30	

Table 1. Input power vs. output power comparisons. The Mirage unit reached saturation at 22 W out. The Alinco unit reached saturation at 32 W out.

tinues to provide almost 10 more Watts of usable output. Overdriving the Mirage results in no additional output but current consumption continues to rise (?).

Spectral purity is comparable in both units, and they meet FCC specifications regarding spurious and third-order harmonics. As far as current consumption is concerned, the Alinco is more efficient—it draws but 3.1 Amps at 20 Watts output; the Mirage requires 4.7 Amps to deliver the same power output.

Since both units employ COR circuits for rf-sensed keying, a logical number to measure is COR sensitivity—otherwise known as the lowest level input signal required to "trip" the COR circuit and put the amplifier in line. Here the Mirage wins out, for it required less than 50 milliwatts of rf to switch on. The Alinco is a bit more insensitive and needs about 100 milliwatts. However, either level is easily below the typical "low power" setting on the average hand-held.

On to the preamplifiers! One gripe I've had in the past with outboard power amplifiers is the poor performance of the preamplifiers that come with them. (So far, the best I've seen have been the Microwave Modules preamps using GaAsFETs and high-performance MOSFETs.) Table 2 shows how the two preamps stack up against each other. Note that while we are sort of comparing apples and oranges—each preamp uses a different type of device, GaAsFET vs. MOSFET—the results are surprisingly similar!

The GaAsFET in the Alinco measured out at 10 dB gain up to an input level of −4.5 dBm, at

	Alinco ELH-220GF	Mirage C22 A
Gain	10 dB	9 dB
1-dB Compression Point	+4.5 dBm	+10 dBm
Minimum Discernible Signal in 1-kHz Bandwidth	−122.1 dBm	−120 dBm

Table 2. Here's how the two preamps stack up against each other.

which point the output started to drop off. This number (called the 1-dB compression point) would be considered fair for a GaAsFET. (A 1-dB compression point of 0 dBm would be good, and above that excellent.) The MOSFET in the Mirage measured out to 9 dB of gain up to an input level of +1 dBm—much better performance.

What does this mean to the average user? With a higher 1-dB compression point, the preamp exhibits better linearity and less tendency to compress and "crunch-up" in the presence of a strong signal. Such compression can result in the generation of secondary and tertiary spurious signals as well as mixing products at the preamplifier's output. In this case, it would be less of a problem with the Mirage when operating in the presence of a very strong adjacent channel signal.

Both preamplifiers exhibited better than average sensitivity. The Mirage was able to resolve a signal of −120 dBm in a 1-kHz bandwidth measured on the spectrum analyzer. The Alinco did slightly better, resolving a level of −122.1 dBm in a 1-kHz bandwidth. With these numbers, I wonder why Alinco bothered with the GaAsFET, as a well-designed MOSFET would have done as well.

Operating Impressions

Both units were tested in my Honda Civic over a one-week period, using a direct connection to the battery through #12 wires. The driving sources were alternately a Kenwood TH-31AT and an ICOM IC-3AT. In all cases the antenna used was a Larsen 220-MHz magnetic-mount 5/8-wave gain antenna.

One problem that both units exhibited occurred when the TX power was on and the RX switch (preamp) off, as I transmitted on 2 meters using my Kenwood TR-7400A. The COR relays chattered furiously in the presence of high rf power (25–30 Watts). Why this happened, I have no idea. Possibly rf was picked up from the 2-meter antenna's coax and coupled into the dc power leads of the amplifiers.

Both the Mirage and Alinco performed reliably. In many cases, the preamps proved to be a boon, as 220-MHz propagation changes can be quite abrupt, resulting in rapid picket-fencing on weak signals. The preamps alleviate this to a great deal, and don't appear to exceed the transmit coverage. In all cases I employed FM mode, so the keying was always solid. I tested both units off the bench with a low-level SSB signal using delayed drop-out keying, but still prefer hard keying in SSB or CW mode. Neither amplifier offers this option, though.

The two units are so small you can tuck 'em away almost anyplace—real important in the smaller imported cars. If you choose to use them while mobile, I'd suggest making up a pigtail out of RG-8/X from your HT to the amplifier, and use a 90° BNC connector on the HT to allow the cable to swivel, reducing strain on it. Avoid 1/4-wave or multiples thereof in the length; aim for 1/2- or full-wave multiples. Although both amplifiers exhibited a good impedance match at the input (better than 1.3:1), it can't hurt and might squeeze a few more Watts out.

Drumroll

Now—the envelope please. And the winner is . . . Alinco, but by the slimmest of margins. It all came down to this: The Alinco could be driven with up to 5 Watts and delivered 30+ Watts for the effort, while the Mirage mysteriously leveled off above 2 Watts drive. While the Mirage had the better preamp, the ultimate criterion for making the decision is how well the amplifier amplifies. In almost every other department the two units came up almost even.

Reader Service numbers: Mirage 201; Alinco 202.■

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73 Review

Dick Smith 100-Watt VHF Amplifier Kit



by Allan J. Perrins WB6PHE

Dick Smith Electronics
PO Box 8021
Redwood City CA 94063
Price class: $150

Number 12 on your Feedback card

Sometimes a little more power is all that you need to access a distant repeater or to make that DX contact. How about a lot more power—say 110 Watts or so for 10 Watts in? Need more mobile power with your hand-held? Would 43 Watts out for 2 Watts in make a difference? If you're willing to save a few bucks by spending a few hours with a soldering iron, the Dick Smith 100-Watt VHF amp kit will definitely fill the bill.

Appearance

The completed unit looks very professional. In fact, the only external giveaway that it is a kit will be the lack of pop-rivets holding the case together! All case parts are black anodized, as is the large heat sink (the photos are of a prototype, which had aluminum panels). Front and rear panels are silk-screened with control and connector nomenclature. Rubber feet are provided for base-station use, but as usual with amplifiers, no provision for mobile mounting is made. Fortunately, no parts mount to the bottom of the case and it may be drilled for mobile use. UHF connectors are provided for transceiver and antenna connection.

Circuit Analysis

As with most power amplifiers, there really isn't too much stuff in the box. The heart of the unit is a pair of Mitsubishi 2SC2694 transistors, each rated at 75 Watts. T-R switching is handled by a pair of low-loss coaxial relays, accounting for the low 0.6-dB insertion loss in receive. There is a third relay used to switch power on and off to the power transistors and to the "on air" light. In this way, current consumption during receive is held to about 50 mA, primarily because of the meter lamp. In the SSB/CW mode, the amp stays "on" for a short time after carrier sensing drops out due to the nature of SSB and CW transmissions.

Construction

As in many of the Dick Smith kits, the manual is a reprint of an *Electronics Australia* article. This one was run in March, 1986. Be prepared to read it several times and to translate it from Australian to "American." It is, however, unfair to compare the Dick Smith kits with the ones from our old friends at Benton Harbor. If you consider the Dick Smith offerings as "projects" instead of kits, the level of documentation becomes more tolerable. It is assumed that the builder has some knowledge of rf circuitry and construction practices.

The lay ham should have no trouble with this kit/project, however, as the manual/article contains all the necessary information if you're willing to dig. For instance, page 4 of the manual/article directs you to cut the supplied brass shim stock into specified strips and fit it to the PC board "as shown in Fig. 2." I'm sorry, but if you've never built a power amp before, it doesn't make any sense. But if you refer to Fig. 9 on page 7, the fitting of this shim stock becomes clear—it ties the top and bottom ground plane of the PC board together right at the rf transistors.

This hurdle passed, the remaining construction is pretty garden variety. Be sure to refer to Fig. 5 for proper orientation of the variable caps, as the adjustment screws will have high rf voltage if they are installed backwards. You'll have to wind a few coils—no sweat, make them just as they appear in Fig. 7 and you won't go wrong. Remember, the dimensions are in millimeters! Instead of gluing the meter to the front panel, you could fashion "brackets" made of stiff wire soldered to the inside of the front panel. Fortunately, there are lots of good photographs to assist the builder in case of confusion.

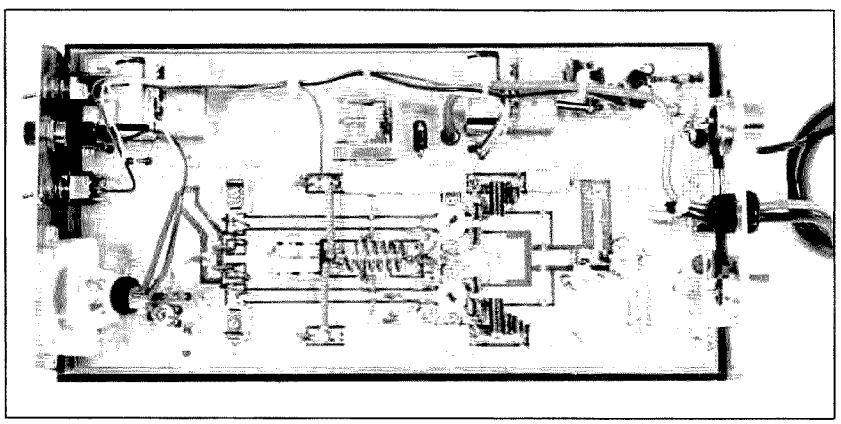
Alignment

If you don't have the specified equipment, beg, borrow, or steal it! You run a real risk of blowing up the rf devices if you try to "wing it." The preferred test setup would be a vswr bridge between the radio and amp and a wattmeter on the amp output terminated in a proper load. An antenna is not a proper load! Assuming the unit was constructed properly, follow the instructions and you should be on the air in 15 minutes or less.

Summary

There is enough room in the case for a receive preamp, but with a measured 0.6-dB insertion loss, I felt that I didn't need it. The heat sink gets warm during prolonged operation, but the power output automatically shuts back as the temperature goes up as a protection measure. Make sure that your load is properly matched, as high vswr will only make the amp run hotter and shorten the life of your rf transistors. If you run the amp mobile, be sure to use heavy cable—the current draw is substantial.

For about a buck and a half a Watt, it's a lot of amp for the money. Besides, if it ever goes out, you'll be able to fix it yourself! ■



A look inside the DSE 100-Watt VHF amplifier.

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Heath IP-2760 Battery Eliminator

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Number 13 on your Feedback card

by Perry Donham KW1O

One accessory that you'll find in every ham's shack is a power supply. Some are fancy with cases to match a particular transceiver, others are general-purpose units in military-looking boxes, and there's always the home-brewed job with the 40-pound surplus transformer.

I needed a reliable 12-volt supply that could handle 10–15 Amps, and decided to try Heath's IP-2760 Battery Eliminator. The IP-2760 will run at 12 Amps forever and can deliver up to 20 Amps on peaks—perfect for my HF station.

The Circuit

As power supplies go, the IP-2760 is pretty simple. A full-wave bridge rectifier is followed by 20,000 microfarads of capacitance; voltage is then passed to an LM-317 monolithic regulator. Four hefty pass transistors provide the current-handling capability. The LM-317 is an adjustable regulator and is set up in this circuit to deliver 8–15 volts with less than a 2% drop in voltage when a load is applied. Output ripple is held to under 1%.

Two front-panel meters are provided to monitor output voltage and current. In addition to the on/off switch, a standby/operate toggle is included—handy if you want to use the supply for testing. Two color-coded banana jacks connect the unit to the rest of the world. The case is Heathkit blue with a white face, and two handles on the top make this a "portable" power supply (it weighs about 20 pounds).

Construction

It took about five hours to put the IP-2760 together. Most of the time was spent stripping wire and building the .09-Ohm, 20-Watt resistors for the pass transistors (four sets of four .33-Ohm, 5-Watt ceramic resistors wired together on two long terminal strips). As usual, there was plenty of material supplied in the kit, with quite a bit of wire left over.

"I ended up glad for the minute detail when it came time to really start hooking things up."

The remainder of the five hours was spent trying to get the little plastic strain relief for the power cord to fit into an even littler hole on the back panel. Now, I've seen these things go right in with no sweat, but it was always somebody else doing the work. I have *never* been able to get the buggers in without completely destroying them. And the manual just mocks me: "Place the line cord in the slot. Squeeze the two segments together. Insert the rear half into the hole." *As if it were that simple!*

Everything else went smoothly, although be very careful when you handle the finned heat sinks which attach to the sides of the chassis. They are *very* sharp. All of the transistors are socketed, and a generous amount of thermal compound is included. I was a bit concerned about the plastic covers used on the transistors, but they seem not to be harmed when the supply is running full out.

During construction, I kept wondering whether or not I could go faster if I just ignored the step-by-step instructions. Especially with a project this simple, all of the "Connect one end of the 12" black wire to Q6 lug C" instructions tend to get tedious. I stuck with it, though, and ended up glad for the minute detail when it came time to really start hooking things up. Wires that had been cut to a specific length were (of course) just the right size to reach to tab C, and everything fit perfectly.

I did, however, end up ignoring the instructions regarding bending wires. In many cases a wire is to be bent to a particular shape to make it from one connection to the next; I found that I couldn't manage to pre-bend the wire and have it fit. It was no big deal, I just bent one end and then measured the distance by holding it up to the circuit.

I also was a bit put off by instructions that had you solder a wire into place on one end and then remove an additional amount of insulation from the other end. This places unnecessary stress on the solder joint, so I simply stripped the wire before it was soldered.

Summary

I've built several Heath kits in my years as a ham, starting with an HW-16. They always work. The IP-2760 started right up, and the measured voltage matched the published specifications. It costs a bit more than most power supplies in its category, but I think that the pleasure of putting it together and the ability to repair it yourself are well worth the additional cost. I think that you'll find the IP-2760 a useful addition to the shack, whether you use it as a dedicated power supply or a test-bench voltage source. ■

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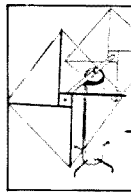
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A Power Supply Primer: Part I

Without a well-regulated and reliable power supply, your state-of-the-art rig will work just about as well as a megaphone.

Number 1 on your Feedback card

No matter how you cut it, the dc power supply is of critical importance to the success of any construction project. It's easy to understand how a project needs correct dc power to operate—about that there is little argument. But what about reliability? The dc power supply is unfortunately the last thing thought of by both amateurs and professional designers. Let me make a few points in that regard.

Point One. During a time when I worked repairing medical equipment at a major hospital, records were kept regarding all repairs. It was found that (over a six-month period) 36 percent of all failures were in the dc power supply either as primary or secondary failures. No other single kind of failure even approached the power-supply failure rate.

Point Two. Several well-known amateur radio transceivers suffered excessive downtime due to underspeced power-supply rectifiers. Once the amateurs involved followed the derating advice that will be given in this series, the reliability problem went away (except on Field Day, when all bets are off!).

Point Three. While working for the Food and Drug Administration, I had to examine reports of excessive failure in a certain medical device (fortunately not a piece of life-saving equipment). More than half of the failures reported for that equipment were either rectifiers, filter capacitors, or voltage regulators in the dc power supply—the designer overlooked some elementary design rules which even a novice could appreciate and follow!

Point Four. The US Naval Material Command, recognizing that low-voltage dc power supplies in Navy equipment are a major source of reliability problems, issued tough new guidelines for the design of supplies in military electronic equipment.

Clearly, the design of dc power supplies is a nontrivial matter when considered from a suitability and reliability point of view. In this article and those to follow, we will discuss the proper design of small dc power supplies for amateur and hobbyist applications. In order to keep the arithmetic to a minimum, we will use "rules of thumb" which are proven effective in some cases. We will also provide several Basic computer programs to assist in working some of the arithmetic.

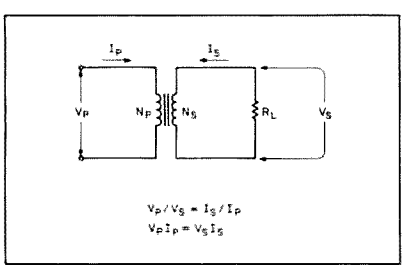


Fig. 1. The transformer is essentially a voltage converter.

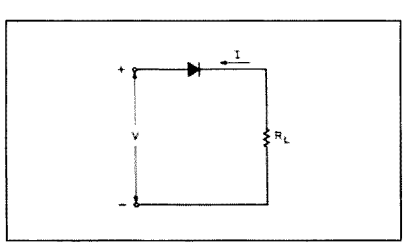


Fig. 2(a). Forward-biased half-wave rectifier.

Basic Elements of the Dc Power Supply

The basic dc power supply consists of the following elements: *transformer, rectifier, filter,* and sometimes *voltage regulator.* Also included in some dc supplies are the following features: *overvoltage protection, current limiting, fusing, transient protection,* and various *status indicators.* In the sections to follow, we will discuss each of these.

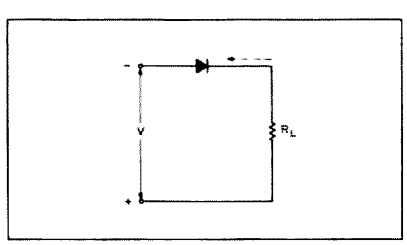


Fig. 2(b). Reverse-biased half-wave rectifier.

Transformers

The transformer (Fig. 1) is essentially a voltage converter. It changes the standard line voltage (115 V ac in the U.S.) to a higher or lower voltage required for the operation of electronic circuits. In some other cases, the transformer will be used for *isolation* and will deliver the same output voltage as is applied to the input. The main use of these transformers is *safety.* Many electronic appliances (especially but not universally those marked "ac/dc") are unsafe when operated either out of doors or in a "grounded environment" indoors (e.g., in the cellar on a concrete floor).

Most of the transformers which we will consider are *step-down* types because solid-state electronic circuits typically operate from lower voltages. The "typical" range for most projects is 1.5 V dc to 30 V dc: Linear ICs tend to require ±4.5 V dc to ±18 V dc; CMOS digital circuits use ±4 V dc to ±15 V dc; TTL digital circuits require 0 and +5 V dc (regulated); transistor circuits require the entire range given above. Some integrated circuits fall outside of the ranges above, but the limits are proper for most devices.

Because the transformer is very efficient, stepping the potential down in the secondary winding increases the current available for

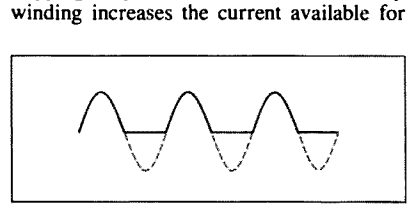


Fig. 2(c). Output waveform of a half-wave rectifier.

any given voltage level (the opposite is true for step-up transformers). The primary volt-Ampere (VA) rating (volts x Amperes) is very nearly equal to the VA rating of the secondary. Simply stated: $V_{pri} \times I_{pri} = V_{sec} \times I_{sec}$, where: V_{pri} is the voltage applied to the primary winding, V_{sec} is the voltage appearing across the secondary winding, I_{pri} is the current flowing in the primary winding, and I_{sec} is the load current drawn from the secondary winding.

In most transformers, the primary winding is closest to the core and so is not able to dissipate heat to the air as well as the secondary winding. As a result, the limiting factor for the transformer is the *primary VA rating*. This rating should not be exceeded, or low reliability will result. As a matter of normal procedure, I prefer to specify the primary VA rating at not less then 120 percent of the expected power requirement for applications that are analogous to the "intermittent commercial and amateur service" (ICAS) ratings given for vacuum tubes (Watts = volts x Amps).

Where service is continuous or where the environment is hostile (which usually means heat dissipation is limited), then I prefer to specify a VA rating that is 200 percent of the power requirements. In other words, if a project will draw 3 Amperes at 6.3 volts (P = 3 x 6.3 = 18.9 Watts), then I would look for a VA rating of 23 for ICAS-type service or 38 for critical service. These figures translate into secondary current ratings of greater than 3.7 Amperes and greater than 6 Amperes, respectively.

In general, for ICAS-type service, military transformers can be operated at secondary currents greater than the marked values because they are normally derated considerably. I would not recommend pushing these ratings for critical service, however.

Rectifiers

The rectifier converts the alternating current from the secondary winding of the transformer into pulsating dc. The output of the rectifier is not the "pure" dc which we would obtain from batteries, but it is at least unidirectional and can be "filtered pure" (well, almost pure). The simplest form of rectifier is the half-wave rectifier.

All rectifiers operate on the same principle, whether they are vacuum tube, mercury vapor tube, cold cathode gas tube, or solid-state PN junction diodes (or even "mechanical rectifiers," which the old-timers will remember): They produce unidirectional current from bi-directional ac current by virtue of *conducting current in only one direction.* When an ac sine wave is applied to the input of this circuit, current passes through the rectifier only when its anode is more positive than its cathode, as in Fig. 2(a). On the other half of the ac cycle, Fig. 2(b), the rectifier is reverse-biased and so will not conduct electrical current through load R_L.

The waveform associated with the half-wave rectifier is shown in Fig. 2(c). This waveform appears across load resistor R_L. Note that the waveform exists only when the

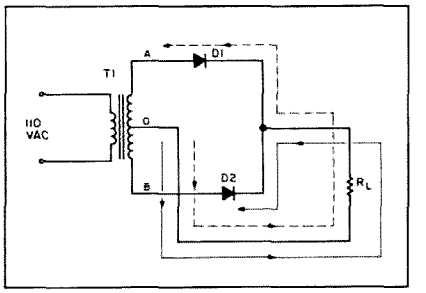


Fig. 3(a). Basic full-wave rectifier using a center-tapped transformer.

input waveform is positive; the negative half-cycle is lost. Since half of the cycle is not used, the half-wave rectifier is wasteful of energy.

The half-wave rectifier has an average output potential that is approximately 45 percent of the applied rms potential, and its "ripple" amounts to 120 percent. To add to the problems of this design, the transformer used must have a primary VA rating that is 40 percent higher than is required if the entire cycle were used (as in full-wave rectification).

A basic full-wave rectifier using a center-tapped transformer is shown in Fig. 3(a). At any given ac peak voltage, one end of the transformer secondary is positive while the other end is negative. The center-tap is at a potential that is half that found across the entire secondary. Therefore, if the center-tap is used as the common reference voltage, then equal and opposite polarity potentials are found at either end of the secondary with respect to the center-tap.

Let's consider the case when the top of the secondary is more positive than the bottom. Current flows from the common center-tap through load resistor R_L and forward-biased diode D1 (whose anode is more positive than the cathode) and then back to the transformer secondary winding. During this period, diode D2 is reverse-biased due to the negative potential on its anode, so no current flows in D2.

On the alternate half-cycle, diode D1 becomes reverse-biased and D2 is forward-biased. Current then flows from the center-tap

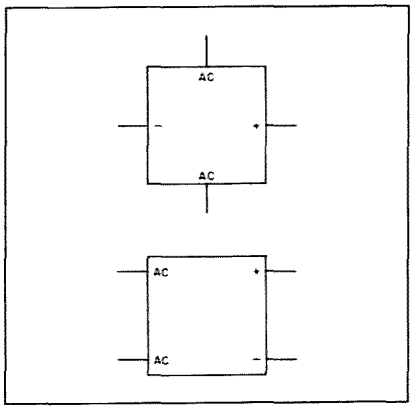


Fig. 5. Circuit symbols for integrated bridge-rectifier assemblies.

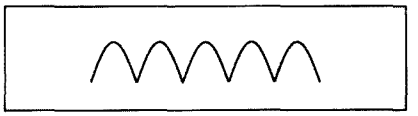


Fig. 3(b). Characteristic double-humped waveform of full-wave rectifier.

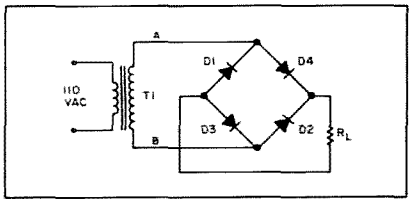


Fig. 4. The bridge rectifier requires no center tap on the transformer.

through R_L and diode D2 back to the transformer secondary.

Note that in both cases the current flows in the *same direction* through load resistance R_L. This action produces the characteristic "double-humped" waveform across R_L shown in Fig. 3(b). We can say the negative half of the ac cycle is "folded up" to the positive side of baseline by the switching action of the diodes.

Another form of full-wave rectifier is the "bridge-rectifier" circuit shown in Fig. 4. It employs a diode "ring" (D1 through D4) for rectification. The secondary of the transformer is not center-tapped because the diode ring provides the negative (and sometimes grounded) zero reference point. The two "corners" of the bridge circuit labelled "−" and "+" go to the positive and negative dc outputs of the power supply or to the same polarity points on the filter capacitor.

Although some designs use individual rectifiers for D1-D4, the trend today is to use a bridge "stack" that includes all four diodes in one package. Fig. 5 shows two common circuit symbols for these devices.

Since the bridge rectifier employs the en-

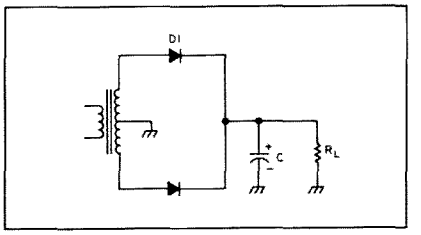


Fig. 6(a). Capacitor C smooths out the pulsating wave.

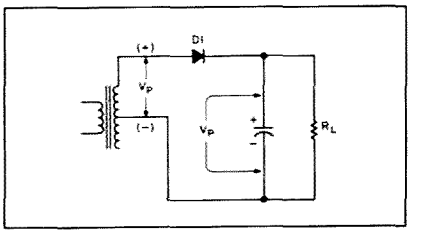


Fig. 6(b). This is what D1 sees on the alternate half-cycle.

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tire secondary voltage, it produces a pulsating dc output potential that is *twice* that of the regular full-wave rectifier that needs a center-tap, assuming the same transformer (of course). There is one little catch, however. The bridge rectifier can safely deliver only half of the output current from that transformer! This requirement is based on the fact that the primary VA rating still must not be exceeded.

If the transformer employs a center-tapped secondary winding then it is an almost sure bet that the manufacturer rated the device for regular full-wave—not bridge—service. We can use that transformer for bridge service, but we should accordingly derate the output current by one-half. If the transformer is not center-tapped, then it was probably designed for bridge-rectifier service and can be used at the full rated current.

The average dc potential across an unfiltered full-wave rectified power supply (bridge or otherwise) is approximately 90 percent of the applied rms potential. Full-wave supplies produce 48 percent ripple, which is a lot less than half-wave circuits but still requires filtering. Since both halves of the ac cycle are used, the ripple frequency of a full-wave supply is twice the line frequency, or 120 Hz for a 60-Hz power line; half-wave ripple frequency is the same as the power-line frequency.

Rectifier Specifications

Solid-state rectifiers are generally reliable devices. Premature failure of rectifiers is usually due to improper specification by the design engineer. There are two principal rectifier specifications of concern to us: *peak inverse voltage*, or piv (also called *peak reverse voltage*), and *forward current*.

Peak Inverse Voltage

The peak inverse voltage is maximum reverse-bias potential that the rectifier can sustain without damage. It is this specification that seems to give the most trouble. The problem is that many designers fail to recognize the actual reverse voltage in a circuit that contains a reactive element like a filter capacitor. Most filters use a capacitor across the output of the rectifier, as in Fig. 6(a). This filter charges to the peak voltage across the secondary, V_p. On the alternate half-cycle of the ac, the diode is reverse-biased and the capacitor charge is effectively in series with the secondary voltage. This is shown in the redrawn version of the circuit, shown in Fig. 6(b). Thus the actual reverse voltage is *twice* what one might suspect intuitively.

Since V_p is 1.414 times the applied rms voltage, the peak reverse voltage seen by the rectifier is 2 x 1.414 x V_{rms}, or 2.83 V_{rms}. The piv rating of the rectifier must be at least 2.83 times the applied rms voltage, and three to four times would allow a safety margin for voltage rating tolerances.

The piv rating error was the one made by a manufacturer of amateur transceivers. The HV rectifier diodes were rated at 1000 volts piv, and the applied voltage was 450 V_{rms}. Thus, because of the filter capacitors, almost 1300 volts were applied to those diodes in the reverse direction, and the result was new diodes and blown fuses every few months!

As a general rule, it is wise to use 1000-volt-piv diodes for all applications up to 300 volts rms, including low-voltage power supplies. In the 1-Ampere size, the 1N4007 is a good choice.

Forward Current

The forward current rating of the rectifier is the maximum sustained current that the device will pass in the forward-biased direction. Do not confuse this rating with the surge current rating, which is much higher. There might be a 25X factor between the two ratings. In other words, a 1-Ampere diode might have a surge current rating of 25 Amperes or more. This rating is the current that is tolerated by the diode for one cycle of the ac input waveform, or less than 17 milliseconds at 60 Hz!

In some cases, there has been a little, er, uh, creative spec writing on the part of *some* rectifier vendors. Since amateurs and hobbyists can often use ICAS-type ratings, they tend to rate the diode at twice the real forward current rating—especially in the over-1-Ampere category of devices. Thus, I can recall seeing a diode marked with a type number that Motorola claimed was rated at 1.5 Amperes being hawked in a local dealer as a 3-Ampere device! Since Motorola made the thing, I tend to trust their label over that of a surplus rebrander.

In the case of bulk-packed "bargain" rectifiers, the forward current rating is an out and out lie—not merely an almost-reasonable stretching of the truth. The lack of a type number or recognizable semiconductor manufacturer's logo generally betrays these devices. If the rectifier is of uncertain parentage, then be suspicious and derate them by 50 percent or more (in other words, consider a "1-Ampere" device to be a 500-mA rectifier). Since I prefer to specify rectifier forward current at twice (or more) the expected normal maximum load current, these devices should be rated by you at one-fourth the load current.

When you actually mount either a replacement (in case of repair) or an original rectifier, be sure to give the device plenty of breathing room—it gets quite hot. Axial lead rectifiers should be mounted 1/4" from the surface of the printed circuit board, while stud-mounted rectifiers should be mounted on heat sinks. Bridge stacks intended for PC-board mounting should also be mounted with breathing space between them and the board. When laying out a new project, do not mount the rectifier in close proximity to heat-sensitive circuits such as oscillators, amplifiers, and so forth. If an already-built circuit seems unstable with respect to temperature and the rectifier is mounted close to sensitive components, suspect the rectifier as the problem.

Looking Ahead

In the next installment of this series, we will discuss filter circuits for simple low-voltage power supplies. ■

Brad Thompson
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Born-Again Bargain Boards

It's magic! Turn scrap PC boards into an electronic library of pre-etched building blocks.

Number 2 on your Feedback card

I was visiting my friend Bob in his basement ham shack one evening, and I was enjoying myself watching him rummage around in his junk pile as he tried yet again to shrink it to a manageable size.

"Hey, what are those?" I asked as he retrieved a dusty box from beneath a workbench and hauled it toward the basement bulkhead on his way to the trash can.

"It's a lifetime supply of PC boards," Bob said, "all unused, no components, just etched boards."

"Gee, it seems a shame to just throw them away," I said. "There must be something they could be used for."

"What, square Frisbees? Shingles for a leaky doghouse? What earthly good is a PC board somebody else has etched?" Bob laughed. "They've kicked around under my bench for years, and I never did anything with them. Here, you want them? Take them away!"

That's how I wound up with 20 pounds of assorted "pre-etched" circuit boards, a term akin to "pre-owned automobile." Somewhere, some hapless company had made a mistake and ordered too many PC boards for its needs, or perhaps a PC board designer made a few layout errors. It's also possible that the artwork for the board was revised and the old-generation boards were junked, or that the boards were rejected by quality assurance.

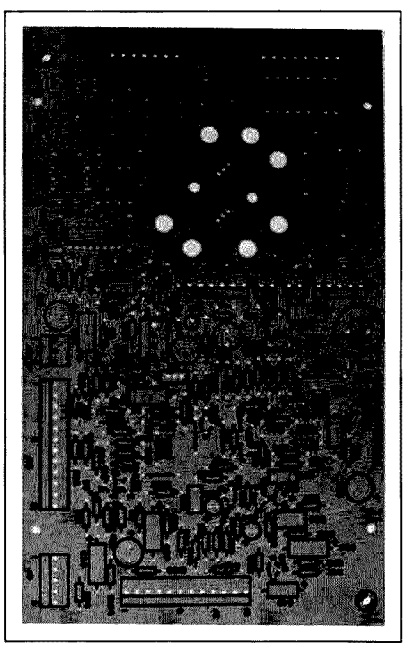


Photo A. Component side of the "Tuner Interface" analog PC board. The power supply section is in the upper right portion of the board.

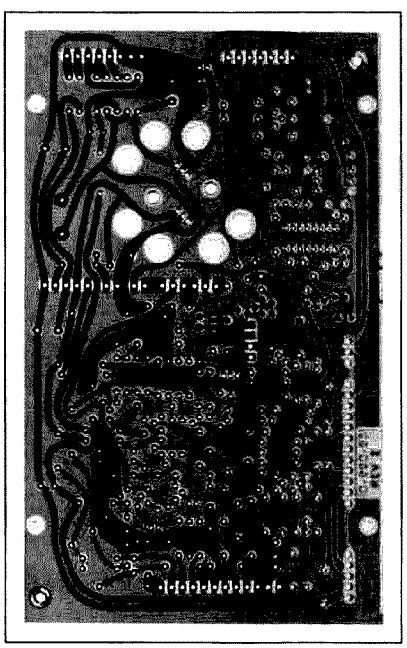


Photo B. Foil side of the "Tuner Interface" analog PC board. The power supply section is in the upper left portion of the board.

Sorting Through the Boards

In any case, what kind of silk purses could be made from this collection of electronic sow's ears? I began by sorting through the boards: Bob had assembled a fine assortment of PC boards, that was for sure.

I divided the boards into two general classes: digital and analog. The digital boards were characterized by large numbers of integrated-circuit DIP pad patterns arranged in neat rows. The analog boards had a few DIP patterns, but most of the pads were laid out in an irregular fashion.

Most of the digital boards were two-sided, with traces on both sides; a few boards were of multilayer construction. When I held these to the light, I could see a dark inner layer which didn't correspond to the traces on either surface of the board. Many of the analog boards were of single-sided construction.

Almost all of the boards were made from the familiar green-colored epoxy-fiberglass material that is widely used in industrial and military electronics. A few of the analog boards were made from a tan-colored epoxy-paper laminate. There were even one or two boards made from brown paper-phenolic material; this stuff was used in huge quantities for consumer goods. Its most notable features are a barnlike smell when it's overheated and its tendency to lose traces when a soldering iron is applied for too long. I threw these boards away.

The Digital Boards

I selected a double-sided digital board for my first experiments. The board was approximately six inches by nine inches and it had pads for approximately 30 integrated circuits, all of 14- and 16-pin sizes. There was a nice gold-plated edge connector on one end and pads for test points at the other.

While traces snaked every which way between IC locations, there was a power bus pattern that ran to the corner pads of most of the IC locations. If I could remove all of the traces except the bus, perhaps I could use the card as a breadboard.

I plugged in the soldering iron and, while it was warming up, I fitted a new, sharp blade into an X-acto® knife. I selected a PC trace at random and cut through the copper close to the IC pad at each end. I held the hot soldering iron onto one cut end of the trace and simultaneously pried up the trace's end with the knife.

Next, I grabbed the raised end of the trace with a pair of needle-nose pliers and pulled. Zzzip! The trace peeled cleanly away from the board and left a ghosty trail on the board to mark its passing.

I fell into a steady rhythm: Cut both ends, heat and slightly lift one end of the trace, and then peel away the traces when a bunch were ready. There were a couple of hazards: It was essential to use a sharp blade in the X-acto knife, and the exposed edges of the peeled-away copper traces were razor-sharp and capable of dealing exquisite "paper" cuts.

When all the signal traces were stripped away, I installed wire-wrap IC sockets and soldered their pins to the power bus pads and two corner pads for mechanical strength. Locations for bypass capacitors were already pre-etched next to each IC, and the junk box yielded a matching edge connector. The board was ready to be wrapped.

Was the time required to strip away the traces well spent? Yes, I think so. Thanks to its power buses and good ground plane, the board would be electrically less noisy than a totally wire-wrapped equivalent, and its cost was much less than a commercially available bus board.

The technique works best for small, double-sided PC boards that are laid out in an open fashion. Multilayer boards are unsalvageable if signal traces are buried in the inner layers; if the inner layers are the power and ground planes, the board may be usable. Also, avoid densely packed, large boards with more than 30 IC locations. The larger boards are harder to work with and are less useful for small projects.

The Analog Boards

Next, I turned my attention to the pile of analog boards from Bob's junk box. At first glance, these boards seemed less useful than the digital boards. There was no regular power-distribution bus, nor were there many DIP locations. There were dozens of identical boards, however.

One board caught my eye: It was a single-sided board that measured about five by eight inches. Its top surface was silk-screened with component outlines and the words "Tuner Interface" (Photo A). The pattern of copper paths on the reverse side (Photo B) was simple enough to trace into a schematic, but why bother?

After staring at the board for a few minutes, however, I noticed an interesting pattern: The outlines of electrolytic capacitors marked with polarity symbols, diodes, and a heat sink were visible in the silk-screened markings. Whatever the board's ultimate function was, it included a power supply section with IC voltage regulators.

Power supplies are basic building blocks common to almost every project, and it's time-consuming to lash one together from scratch. The circuitry doesn't vary much from design to design: There's always a rectifier and a filter capacitor, and often a three-lead voltage-regulator IC of the 78XX family.

The chances were good that the designer of the board used the same building blocks in his power supply. I spent a few minutes tracing etch and discovered that he had. I could install my own components, ignore or cut away the unwanted circuitry on the board, and have a regulated power supply building block for future projects. There were two dozen boards in the pile, so I had a lifetime supply.

Tracing the power supply wasn't hard, so I turned my attention to the rest of the board. Could I figure out what it was used for and perhaps determine what components were used? The low density of components and single-sided construction suggested that the board had been built for use in a consumer product, perhaps a projection television receiver.

I selected a DIP IC location on the board as a starting point and systematically examined all traces going to its pins. Two traces made their way back into the power-supply section, and by examining the polarity markings on the silk-screened capacitor outlines, I was able to determine which IC pin received positive voltage and which was grounded.

With that information, I began a search for a linear IC whose pins matched my findings. I selected a data book and reviewed common operational amplifiers and comparators: no dice. Next, I looked through the consumer IC section of the data book: again, no luck. I switched to another vendor's data book and repeated the process: bingo! There, on page 792 of the RCA linear IC data book was the CA3159E, a "horizontal processor and agc detector" device.

The data book included a functional block diagram of the IC and an application circuit, so I was able to identify the input and output pins that were being used. A little more tracing of PC patterns and I discovered that only the agc portion of the chip was being used. With a little effort, the circuit could be adapted to other functions. I had added another potential pre-etched "building block" to my collection.

Helpful Hints

I found a couple of techniques very helpful to the process of tracing PC patterns. When an etched run has been followed to its ends, it's a good idea to mark the run to avoid confusion. I found that a Pilot ultra-fine point permanent marker, type SC-UF, worked well and semi-permanently marked both copper traces and fiberglass. The marker's fine, sharp point also made it possible to write part numbers on the circuit side of the board. Alcohol or solder-flux solvent will remove the ink.

It's also helpful to mark the beginning and end of a trace and then flip the PC board over to see what components are in the vicinity. I took a pair of plastic-headed map pins and blunted their points. It was easy to poke the pins through the trace's beginning and ending holes and then reverse the board.

Once you have identified the function of a PC board or a portion thereof, you can choose to attack the board with a nibbling tool or a bandsaw and cut out the interesting part. Avoid breathing the dust from a glass-epoxy board because it's an irritant and a good substitute for itching powder. Make sure that you haven't introduced any short circuits due to copper burrs when you made the cuts.

Choosing the Boards

If you should find a batch of boards for sale at a flea market, look them over carefully before you decide to buy them. Make sure that the boards have been fully processed. Avoid those that have bare copper traces or chemical residue stains. Some boards have had their gold-plated contact fingers clipped away. These boards may still be useful if an IC location is used as a connector site.

The most desirable boards will have their function and component part numbers silk-screened on the component side of the board. Unlabeled boards, "mystery" boards, and large digital boards are less useful. Do not spend much money on any bare board. Remember, you're buying someone else's mistake and you still have some detective work ahead.

Is it worthwhile to salvage unused PC boards? In general, yes, if you can identify a basic building-block function that you can use. The more boards of a useful type you have, the better, because your research time has a larger payoff.

Don't overlook the educational benefits of pitting your reverse-engineering skills against an unknown designer's efforts. The secret is to take advantage of what would otherwise go to waste and make it useful to you. ■

FIVE BUCKS FOR FIVE BOARDS

A package of five circuit boards is available from the author for $5 ppd. The boards are of mixed sizes and shapes and are representative of the types discussed in this article. Send a check or money order to: Brad Thompson, 77 Waltham Street, Maynard MA 01754.

Terry F. Staudt W0WUZ
4807 S. Blue Spruce Road
Evergreen CO 80439

Defuse RFI

A couple of caps and some coax put an end to crisped lips and cruddy audio.

Number 3 on your Feedback card

The response to "Lightning Never Strikes" in the August, 1986, issue was so great that we decided to reprint this W0WUZ classic from 1983.—Eds.

As a long-time denizen of 10 meters, I have learned along with my like-minded compatriots to suffer when the band is really running well and our friends from 80, 40, and 20 come up to partake of the fun and games. Suffer? You bet!

A ground wire is totally ineffective over 1/8 wavelengths on the frequency in use. Dc yes; rf no. This works out to about 4 feet on ten. I realize it is extremely difficult to achieve a situation where your ground wire is 4 feet or less, *to the earth*, not the toilet!

Another problem (coincidental with the above) is rf feedback in the TX audio, which in its least annoying form makes your voice sound like vibrating chicken wire and in its worst sends spurs running 100 kHz up and down from your central frequency (or from dc to daylight, as we used to say in Navy ECM).

For considerably less than $5, there are steps to take that can result in hearing, either while in QSO or afterwards when the station you worked is talking with someone else, "Lord, the guy in _____ had beautiful audio!" These measures are not new, but like so many other pieces of hands-on know-how, they need to be repeated and correlated every now and then to refresh and instruct those who don't read electronics books on the john.

If your rig is in the basement, effect a 1/2" 45° hole in the wall with a masonry bit or star drill and drive a 6-to-8-foot ground rod, leaving about 5 inches protruding. Seal with waterproof putty or silicone. Properly placed, this will give you about a 1-foot ground connection. For those not in the basement, a coaxial ground is needed.[1] This is a simple miracle that makes your effective ground length only a few inches!

"There is absolutely no excuse for the cruddy signals on HF. . . if you're not going for the solution, you're part of the problem."

A coax ground is made using *good* quality (95% shield braid) coax such as Columbia 1107 or 1108 RG-8/X or Mini-8 with a stranded center conductor. The center conductor is used as the ground wire, connected to the *rf generating unit* and the outside ground system. It's bypassed at each end with a .01-uF, 1-kV disc capacitor to the shield braid (see Fig. 1). Don't tie all of your station's components together with zip cord or aluminum wire. Let the coax shield handle the dc grounding between units as it is seldom over a foot or so long. Otherwise, you set up ground rf loops that defeat everything you've done.

Microphones seem to be universally designed for use in high school auditoriums, with no rf suppression whatsoever. This is simple, so simple that there is absolutely no excuse for rf feedback in this area. All that is usually necessary is to install a .01-uF disc capacitor across the microphone cartridge (do it quickly because it can't take much heat!) and add a 1-mH choke in series with the audio high lead. This may be done at the mike or on the inside of the mike jack of the transmitter, which is more convenient when using several microphones. If using a power mike, ferrite beads on the transistor base leads and a pi filter using two .005-uF capacitors with a 1-mH choke are called for (Fig. 2).

In summation, there is absolutely no excuse for the cruddy signals on HF, and if you're not going for the solution, you're certainly part of the problem. These steps will also knock an RFI problem in the ditch. ■

Reference

1. "The Capacitive Coaxial Ground Wire," *73*, May, 1980, p. 82.

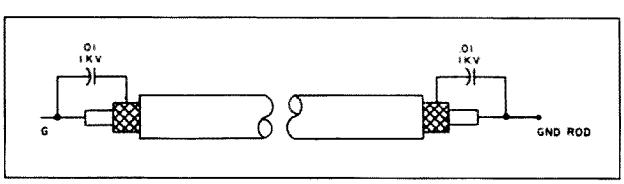


Fig. 1. The coax ground couldn't be simpler.

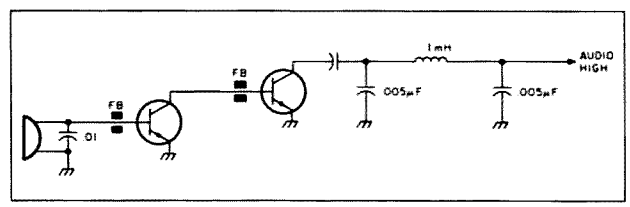


Fig. 2. A little rf suppression will dramatically improve your transmitted audio.

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Commodore's RTTY Riot

If you can get the C-64 away from the kids, try this simple method of computerizing your TTY operation.

Number 4 on your Feedback card

The Baudot Model 14, 15, and 19 Teletype® machines have to some extent fallen from favor. Even the wondrous Model 33 (ASCII) is now selling at dumping prices at flea markets. It's no secret that flea-market prices tend to be a bellwether of change. In this case, they simply reflect the impact of personal computers on the ham shack. But the rush to get rid of the old reliable printer workhorses may be a bit premature: They continue to be great hard-copy machines for RTTY, and interfacing to the C-64 through the current loop can be done for just a few dollars and very little effort.

This home-brew C-64 interface/KG3V-software combination will go receive or transmit at 45 bps or 110 bps with the Hal ST-6—and probably with any terminal unit that is presently connected (or connectable) to the 60-mA loop of a Teletype® machine such as a Model 14, 15, or 19. (300 bps and 1,200 bps with home-brew KG3V modem—see July, 1981, *Ham Radio*.)

There are a number of ways to work out a practical hookup between the older RTTY tuning units, printers, and the PCs most often found in ham shacks. Except for its cost effectiveness, this project doesn't break any new ground. And as for the computer part, the Commodore 64 appears to be as popular a choice as any for the ham shack. It also happens to have a user port that is a very friendly place to gain access to the operating system.

We have one Model 15 working perfectly with this interface and a ten-year-old home-brew demodulator built with polar relays and another with a Hal ST-6. With regard to the latter, as the loop current is supplied by the tuning unit, the TTY printer can be eliminated if desired. When this is done, a current-limiting device (100 mA maximum) must be installed in the loop to protect the interface. (Note: Some ST-6s may require a small modification to enable 75- to 110-baud operation. The details of this mod are available from the Hal corporation.)

Fig. 1 shows a functional block diagram of the various units required to complete the project. If an existing station is to be converted in this manner, nothing need be disturbed except for breaking the loop current line to make a series connection with the interface (two wires). The C-64 is not disturbed in any way at all. Simply plug in the interface at the user port and load the "RTTY" program.

One advantage of using this system is that when you are not in the shack, the computer can be switched off without breaking the loop. Therefore, autostart traffic can still be copied with the page printer.

The software required to turn your C-64 into a RTTY machine is the brainchild of Thomas B. Zelwanger KG3V. The program *and* documentation (at latest revision) can

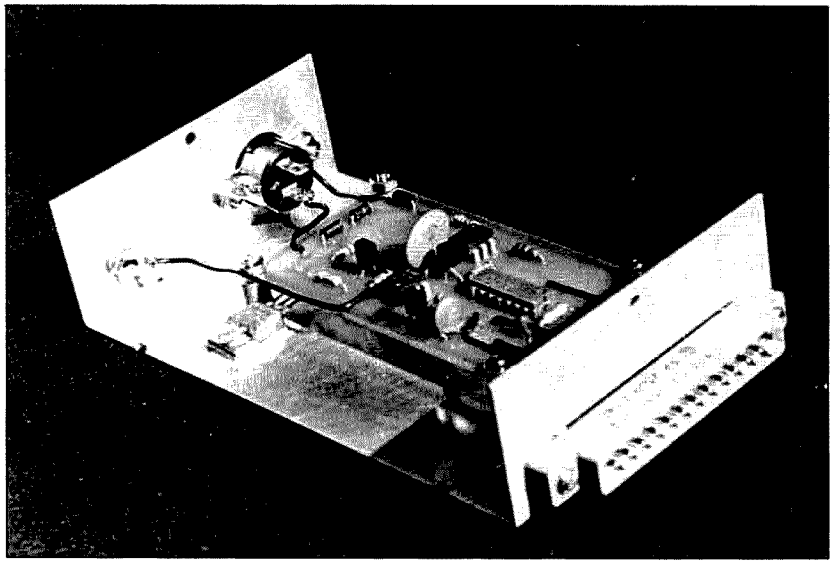


Photo A. The fully assembled interface with top cover removed.

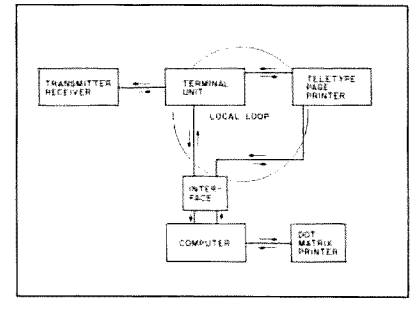


Fig. 1. Block diagram, RTTY local-loop configuration.

be obtained from KG3V (PO Box 62, State College PA 16804). Send Tom a blank tape or disk along with $2 for postage and packing. The purpose of his generosity is to encourage greater activity on RTTY, and while you won't find all the bells and whistles of commercial software on the KG3V program, it is nevertheless very effective.

Construction of the interface is quite conventional. There is lots of room on the board for the parts. Use standard printed-circuit cautions in the parts assembly. Radio Shack part numbers are given in the parts list when possible.

Fig. 2 shows the schematic diagram, Fig. 3 shows the circuit-board layout, and Fig. 4 shows the parts placement in graphic scale.

Q1 (RCA SK-3220/198) is packaged complete with mounting hardware. Substitutes for this part may be packaged individually. This transistor is mounted to the circuit board and to the case for a heat sink. To ensure a precision fit between Q1 and the circuit board and the case, use the spacer length called for and assemble the transistor as shown in Fig. 4. The case requires the drilling of nine holes and a cutout for the edge connector, as shown in Fig. 5.

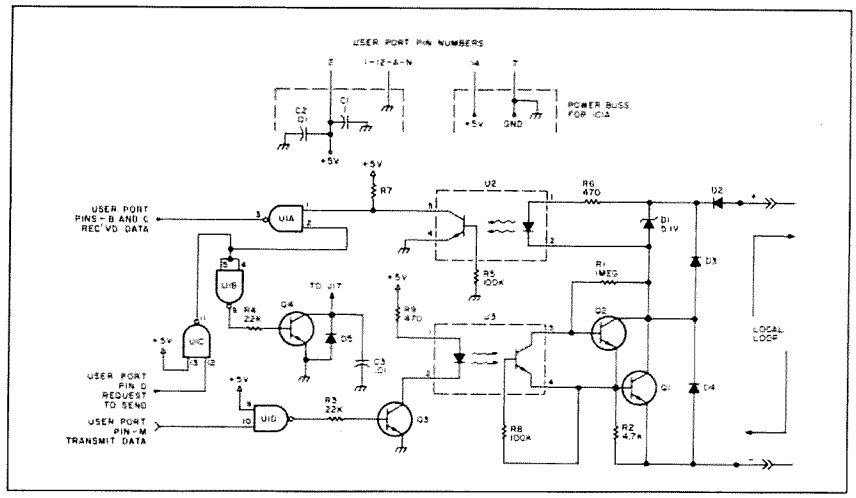


Fig. 2. RTTY/C-64 interface schematic.

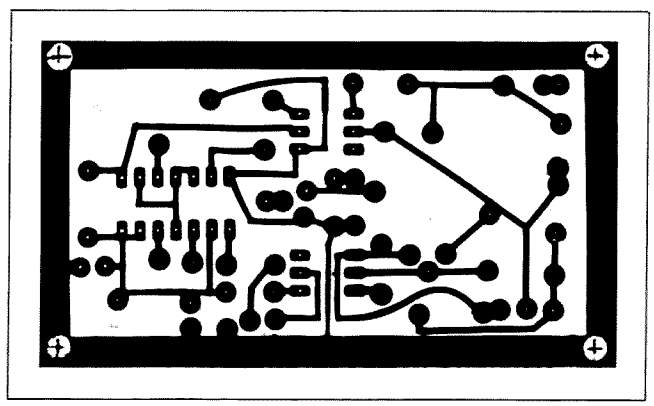


Fig. 3. Interface circuit board.

Circuit Description

As is well known to RTTY aficionados, there are few electrical circuits in use by hams as simple as the common local loop. Its only purpose is to interconnect the peripherals commonly associated with the RTTY mode. This loop, or common line, is a universal message cable for the serial data coming from or sent by these peripherals. However, all RTTY gear (pre-solid-state) incorporates high-voltage circuits and lots of rugged components. Computers are not quite that simple. The object of the project interface is to make the C-64 compatible with the local loop.

The basic function of the interface is to orchestrate the transfer of data between the high voltage levels of the ST-6 (et al) and the TTL voltage levels of the computer.

With the software driver loaded and running, the user port is configured as an RS-232C data port. Add the interface, and the receive serial-data stream enters the computer at pins B and C. On transmit, a request-to-send signal is sent by the computer to pin D, and the transmit serial-data stream leaves from pin M. The request-to-send signal can be used to control the transceiver. More on that later.

Only the pins in Table 1 are used for this project; the remainder can be disregarded.

The project interface is seen by the terminal unit as just another peripheral. Connection to the loop is made by breaking the circuit and splicing in the interface with a serial connection through PL-1. Polarity must be observed. Turn off power to the computer before plugging in the interface, and switch off the tuning unit before working on the external loop circuit.

The emitter of Q1, emulating a normally closed switch, is enabled open when the base current of driver transistor Q2 is shorted by the output transistor in optoisolator U3.

R1 supplies a small current to Q2, which provides a bias to hold Q1 closed during mark pulses. This normally closed switching default is an important feature. The normally closed Q1 switch preserves local-loop continuity and allows data flow through the terminal unit and printer, even when the computer is switched off or disconnected from the project interface.

Data generated by the computer has a logic orientation as is required for RTTY encoding. Mark is a 1 (or 5 volts). Space is a 0 (zero volts). The outbound data stream of ones and zeros is present only on transmit, appears at pin 10 of IC1, and is routed to output pin M.

U1 has four NAND gates. Section U1D is set up to invert the computer output so that mark = 0 and space = 1. The output of this gate (pin 8) drives Q3 through a current-limiting resistor (R3) at the base. Q3 conducts on space and switches on the photodiode portion of U3.

The switched-on photodiode triggers its optically coupled transistor into conduction, which results in a drop in the bias current of Q2, thus turning it off. The normally closed switch then opens. This breaks the local loop for the duration of the space pulse.

Data from the loop is received through optoisolator U2 where the photodiode and series resistor R6 shunts zener diode D1, which is connected in series with Q1. R6 limits photodiode current to 8 mA during mark, or 60-mA loop current.

In the absence of loop current, defined by the presence of space pulses, the U2's photodiode turns off and the phototransistor stops conducting.

When the photodiode switches off, pull-up resistor R7 develops a 5-volt level at pin 1 of U1. Gate U1A inverts the 5-volt level to a logic-0 voltage level. This signal appears at pins B and C on the edge connector.

D3 and D4 avert voltage-spike damage to components on the loop side of the interface. D2 protects the interface from accidentally reversed loop polarity.

The C-64 RS-232C port has full-duplex capability, but it cannot be paired with current-loop RTTY machines because the local loop is not a full-duplex circuit. A design feature of the project interface eliminates interference to received data caused by echoing.

When the control operator elects to transmit, the interface comes to attention with two responses. First, pin D on the edge connector gets a request to send in the form of a logic 1. This signal also appears on pin 12 of U1 (gate C), which inverts the signal. The output of gate C appears at pin 2 of U1 (gate A), which cuts off the output of this gate.

This latter feature prevents transmitted data from filling the C-64 receive buffer. Without it, the receive buffer will fill from the previous transmission and dump to the

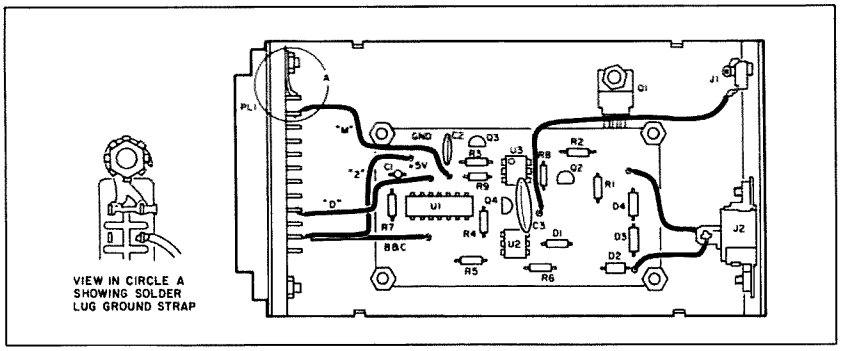


Fig. 4. Parts placement.

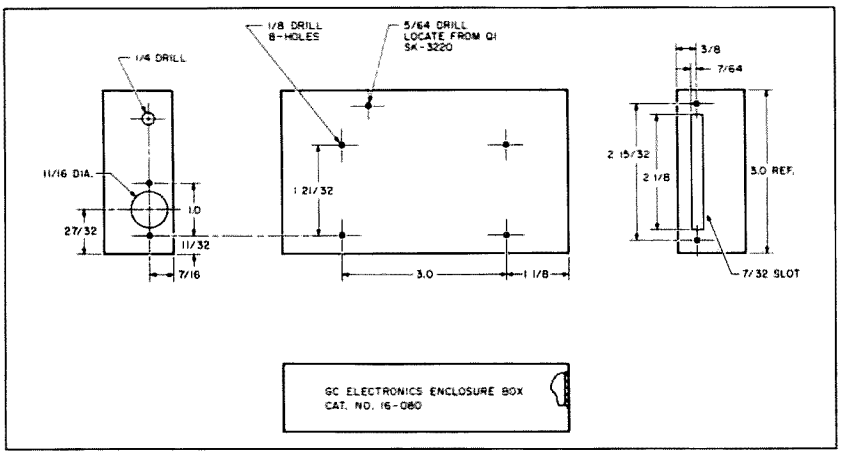


Fig. 5. Case modification.

screen before the incoming data stream can be reviewed.

An additional design feature utilizes an option available on most transceivers and transmitters for using the PTT line. With this feature, the transceiver can be controlled from the computer keyboard. This is done by transistor Q4, which is biased by U1B through current-limiting resistor R4. U1B inverts the logic 0 sent by U1C and turns on Q4. CR4 protects Q4 from the reverse EMF generated by relay coils in some radio equipment.

Q4 is heavy enough to switch on the PTT current in most rigs, but a PTT line with an open voltage greater than 20 volts will rate something heavier, such as the MPS-A42.

Putting It Together

First, use Fig. 3 and direct etching transfers (or your preferred method) to prepare the circuit board. Next, prepare the case by drilling the mounting holes (see below for details of Q1 mounting) and cutting clearance for the edge connector.

The etched and drilled board can be stuffed with abandon, except for the mounting of Q1. Dress Q1's leads as shown in Fig. 4 and proceed as follows: With the exception of Q1 and miscellaneous wires, all parts should first be assembled to the PC board. Special care must be taken with Q1 at this point to ensure a stress-free assembly of the PC board, transistor, and case. Assemble Q1 and solder in place.

The PC board—with Q1 soldered in position—is mounted on the lower half of the box. Use spacers on the 4-40 screws as specified. The fasteners can be finger-tightened to stabilize the board temporarily.

Bend and adjust the leads of Q1 so that the mounting surface is in firm contact with the box and mark the location of the mounting hole. Remove the board and set it aside.

Drill a 9/64 hole for Q1 as marked. This completes machining of the case.

Complete the board assembly by soldering hook-up wires (3" lengths) to the circuit-board eyelets for connections to chassis and edge connector.

Before reinstalling the finished board on the box half, apply a light coating of silicone heat-sink compound to the mica insulator, the back of the transistor case, and the area around the mounting hole on the box cover. Next, with the insulator located between Q1 and the chassis, press Q1 firmly into place and, using 4-40 hardware plus the supplied plastic washer under the nut, fasten lightly. Q1 must be attached to its mounting surface with the insulating hardware packaged with SK-3220.

It is important that Q1 be mounted with care. Mechanically, a good fit is required, and electrically, the mounting tab on Q1 will be at collector potential and therefore must be insulated from the chassis ground.

Pin	Function
A, N	Ground
B	Received data
C	Receive data flag
D	Request to send
M	Transmit data
2	+5 volts
1, 12	Ground

Table 1.

Complete the assembly by installing and wiring the edge connector and the loop connector receptacle. Take care when wiring the edge connector. Make a positive identification of each pin. Your computer's data-port chip will be directly connected to the project interface.

The interface is now ready for testing. *Incorrect wiring could damage your computer*; just follow the hook-up diagram and all will be well.

Testing the Interface

Warning! Open-loop supply voltages may exceed 150 volts. Before working with loop connections, be certain that related equipment is switched off.

Step 1 is a preliminary checkout and should be done before connection with the computer or the loop circuit is begun. First, check resistance from the +5 eyelet on the board to ground. This check should show an open circuit. A low reading that does not vary means that there is probably a construction or wiring error present.

Next, make a resistance check from ground to each loop connection and from ground to the mounting tab of Q1. All readings should indicate an open circuit. If the preliminary check is satisfactory, connect the interface to the loop.

The success of the next test will rely upon the presence of loop current. A stabilized 60 mA is optimum. If the loop current drops out, recheck the polarity by reversing the loop connections to the interface. If the loop current does not hold after checking polarity, the problem can most likely be traced to an error in component placement. If the loop current holds, it will be safe to assume that the loop-switching circuit is working.

Now plug in the interface at the user port and *then* switch on the power. Load and run the RTTY program.

A note about software. This project was designed with the KG3V package in mind. It is probable that software other than this will do as well or better. The KG3V program, however, is available free of charge and is in the public domain. The remainder of these test procedures will assume the KG3V software.

Select mode 0 and hit function key F1. Using a VOM, logic probe, or scope, check the potential on IC1, pin 12. This should be close to 5 volts. Check the potential on IC1,

pin 10. The voltage reading on this pin should drop briefly to zero when the space bar is depressed. This drop in voltage certifies the presence of space intervals.

Check the voltage on R9 at the optoisolator connection (IC3). The results should be the same as those seen on IC1, pin 12. Return the meter probe to IC1, pin 12. The voltage should drop to near zero when function key F1 is depressed. Go to pin 11. This reading should also be close to 5 volts. Failure to get the voltage readings as specified will point first to a solder bridge on the PC board and then to a defective IC.

If everything checks out, it may be assumed that the interface is in good working order. Fire up the RTTY station and tune in a RTTY signal.

In mode 0 (60 wpm) receive, you should "see" any incoming print that is on the local loop. If there is a problem, check the voltage drop across D1. This should read 5.1 volts. The voltage drop across R6 should be close to 3.7 volts. Check across pins 1 and 2 (pin 1 positive, pin 2 negative) for a drop of 1.2 volts. A zero reading here indicates that IC2 is defective.

Before replacing IC2, recheck the values of R6, D1, and the local loop current, which should be 60 mA when closed. If all is well, hit the F1 function key once more and enter some spaces with the space bar. A printer on the loop (turn it on) should show spaces.

Troubleshooting problems with character transmission are best started at the optoisolator side of R9. Look for 4.7 volts on space. The collector of Q3 should go to near zero during the space interval. The voltage drop across pins 1 and 2 of IC3 will be difficult to see without a scope, but it should be close to 1.2 volts.

If the problem persists, check the voltage across pins 4 and 5 of IC3. With no output from the computer, it should be close to 0.7 volts. A reading of zero indicates that IC3 or Q2 is defective. Keep in mind that the voltages around Q1 and Q2 are at local-loop potential during space intervals. If at this point trouble still persists, check the orientation of D3 and D4.

Q1 can be checked by measuring the voltage drop across the emitter and base. A correctly functioning device will develop close to 0.7 volts when the 60-mA holding current is present; the drop across the collecter and emitter will be very close to zero. During open loop periods, this latter voltage will approximate that of the open loop.

One last comment: The project interface will safely handle a loop-current level as high as 100 mA, but it should be avoided. ■

Parts List

Integrated Circuits			
U1	7400 quad 2-input NAND gate TTL	Jameco	$ .29
U2, 3	4N25 optoisolator	Jameco	1.38
Transistors			
Q1	SK-3220 high-voltage power output NPN	RCA	2.75
Q2	MPS-A42 high-voltage driver	Radio Shack	.69
Q3, 4	2N2222 general-purpose NPN	Jameco	.68
Diodes/Rectifiers			
D1	IN4733 5.1-V, 1-Watt zener	Jameco	.22
D2–5	IN4006 HV 1 Amp	Jameco	.88
Capacitors			
C1	.1-uF, 10-V tantalum	Radio Shack	.50
C2	.01-uF, 25-V disc	Radio Shack	.20
C3	.01-uF, 100-V disc	Radio Shack	.20
Resistors (1/4 Watt, 5%)			
R1	1 megohm	Radio Shack	.10
R2	4.7k	Radio Shack	.10
R3, 4	22k	Radio Shack	.20
R5, 8	100k	Radio Shack	.20
R6, 9	470 Ohms	Radio Shack	.20
R7	4.7k	Radio Shack	.10
Hardware			
J1	Mini-jack	Radio Shack 274-251	.40
J2	Multi-pin connector (Jones type) two-pin male*	Radio Shack 274-201	
	Two-pin female	Radio Shack 274-202	1.79
	6" x 6" blank copper circuit board	Radio Shack	2.19
	Direct-etching dry transfers	Radio Shack 276-1577	2.59
	GC Electronics Chassis Box #16-080 (5-1/8 x 3 x 1-1/4)	Shand Electronics	4.07
	12/24 PC edge connector with solder eye terminal	Jameco 12/24SE	3.95
	Seven 3" lengths of #22 solid copper hook-up wire 100' spool	Radio Shack 278-1295	2.19
	#4 solder lug		.10
	60/40 rosin core solder PC type BPO dispenser model DS-1	Fordham Radio	.79

*Required for loop only.

Addresses: Digi-Key, Highway 32 South, Thief River Falls MN 56701; Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002; Fordham Radio, 260 Motor Parkway, Hauppauge NY 11788; Shand Electronics Inc., 2401 Dort Highway, Flint MI 48503.

About Fasteners: The small quantity of fastening hardware required to hold this project together can no doubt be found in the nooks and crannies of most ham-radio workshops, and the cost will be nil. However, for those who are starting from scratch, the following items are available at hobby shops and hardware stores in small-quantity blister packs. Radio Shack catalog numbers are given here for these items. There will be plenty left for the next project.

64-3011 (14 pkg. #4-40 x 1/2 round-head machine screws)	.99
64-3018 (30 pkg. #4-40 machine hex nuts)	.99
Two 64-3024 (24 pkg. assorted spacers)	1.98
64-3022 (20 pkg. #4-40 flat washers)	.99
Nine #4-40 x 1/2 round-head machine screws	.45
Nine #4-40 machine nuts	.45
Two #4 flat washers	.10
Four #4 x 1/4 metal spacers	.40

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4-BAND SLOPER - 160, 80, 40, 30, or 20M		60 ft. long	$ 48 ppd
3 " " - 160, 80, 40M		60 ft. "	$ 43 "
2 " " - 80, 40M		40 ft. "	$ 35 "
3 " NO-TRAP DIPOLE - 160, 80, 40M		113 ft. long	$ 71 "
2 " " - 80, 40M		85 ft. "	$ 55 "
9-BAND SPACE-SAVER DIPOLE - 160 thru 10M *		48 ft. long	$ 85 ppd

* Requires wide-range tuner (80, 40, 20, 15M without tuner)

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Transistors On The Bias

Remember the last time you designed a transistor amplifier? The pile of parts that didn't work? Wells ends all that with this Basic amplifier-designer program.

Number 5 on your Feedback card

If you are an electronics tinkerer and a part-time computer hacker, you need this computer program. It was developed to manipulate the myriad of formulas surrounding one of electronics' most common building-block circuits, the class-A common emitter amplifier (shown in Fig. 1). Because of the flexibility of the circuit, there are infinite combinations of components that will work perfectly well. But what happens to the input impedance if you change the value of R2? Or output impedance when R3 is changed? The value of a computer becomes quickly apparent when you want to play what-if games with the circuit.

To use the computer program, five pieces of information must be entered: transistor beta (h_{fe}), maximum power dissipation, the resistance of R2, the power-supply voltage, and the lowest operating frequency. The most obscure of the five is power dissipation. This may be based upon the maximum device dissipation (spec value) or the maximum that is desired in a specific circuit application. Selection is the user's choice. If you are not familiar with how dissipation values affect the circuit, then working with V_{ce} vs. I_c characteristic curves (Fig. 2) for a typical junction transistor will provide the necessary data.

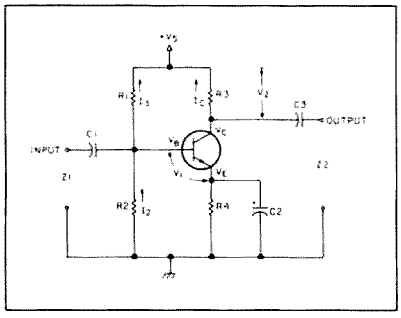


Fig. 1. Class-A common emitter amplifier.

The dotted line represents a constant power dissipation (Pd) and is determined by the product of V_{ce} and I_c at each intersecting point along the curve. All transistors have a maximum dissipation value, but it is not necessarily desirable to operate them at the maximum value in every circuit application. In fact, device reliability (and longevity) can be improved by operating to the left side of the maximum power dissipation curve established by the manufacturer.

Circuit Variables

The selection of maximum power dissipation and the power-supply voltage (V_s) will determine the dc loadline for the circuit. The loadline is like a railroad track in that it establishes an operating path for the transistor within the circuit. All transistor circuit voltages and currents intersect along the loadline, establishing the circuit operating parameters. As an example, a specific collector current and voltage drop between the collector and emitter of the transistor may be found at the loadline intersection with a specific base current value.

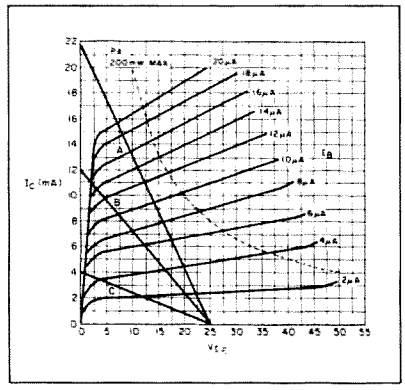


Fig. 2. V_{ce} vs. I_c characteristic curves.

For class-A amplifiers, the base current value is selected to provide a quiescent operating point (QOP) such that the collector voltage value will be one half of the power-supply voltage. Placing QOP at the point equal to one half V_s provides a nearly equal signal swing for both positive and negative signal excursions before peak amplitude distortion occurs. QOP is the zero-signal resting point on the loadline. Resistor R1 determines the base current value, which is used to establish the QOP position on the loadline.

The position of the loadline at location A, B, or C is selected by the amount of power dissipation chosen. Selecting one value over another is a matter of choice based upon various alternatives. In general, the lower the loadline is, the higher the input and output impedances will be. Obviously, though, circuit values are in parallel with the impedance of the respective circuit and will restrict the impedance range variation obtained.

Resistor R2 has the most direct effect on the input impedance, while R3 has the most effect on the output impedance. Signal linearity and gain also are affected by the loadline position. Lowering the loadline will tend to raise the transfer gain. However, signal linearity may be degraded. Therefore, how is the position of the loadline to be selected?

The usual way is to use the cut-and-try technique to work out the circuit values to achieve the desired results. Another technique is to examine the transistor curves and associated formulas to find the desirable circuit values for a given transistor and circuit application. With your help in selecting input data, the computer will work with the formulas, making circuit analysis very easy.

Before starting the analysis, choose a power dissipation value between 1/4 and 1/2 of the transistor's rated dissipation. Some circuits operate at 1/20 of the rated Pd, but in any case, the Pd is chosen to satisfy the cir-

B	Transistor beta
C	Temporary capacitor variable
C1	Input capacitor value
C2	Emitter bypass capacitor value
C3	Output capacitor value
F	Frequency
G	Gain
I	Collector current print variable
IB	Base current
IC	Collector current
I2	R2 current
I3	R1 current
P	Selector variable
P1	Power dissipation
R1	Base-VS resistor
R2	Base-ground resistor
R3	Collector-VS resistor
R4	Emitter-ground resistor
T	Temporary variable
VB	Base-ground voltage
C	Collector-ground voltage
VE	Emitter-ground voltage
VS	Power-supply voltage
V1 + V2	Emitter-base voltage
X	Reactance variable
Z1	Input impedance
Z2	Output impedance

Table 1. Program variables.

```
10 REM DEVELOPED BY HUGH WELLS - 3/86
20 PRINT CHR$(125):REM CLEAR SCREEN/HOME
30 PRINT :PRINT "  TRANSISTOR DESIGN PROGRAM FOR"
40 PRINT "  CLASS-A SMALL SIGNAL AMPLIFIERS."
50 PRINT :PRINT "ENTER THE DATA AS REQUESTED."
60 PRINT :PRINT "TYPICAL BETA (HFE) VALUE ";:INPUT B
70 PRINT "MAX PWR DISSIPATION IN MW ";:INPUT P1:P1=P1*10^-3
80 PRINT "ENTER 1=SILICON  2=GERMANIUM ";:INPUT T
90 PRINT "DESIRED SOURCE VOLTAGE ";:INPUT VS
100 VE=0.1*VS:REM CALCULATES EMITTER VOLTAGE
110 IF T=1 THEN V1=0.7:REM SILICON
120 IF T=2 THEN V1=0.3:REM GERMANIUM
130 V2=VS-VE:REM CALCULATES VOLTAGE ACROSS R3
140 PRINT "ENTER LOWEST OPERATING FREQ (20-300)"
150 PRINT "FOR 3 DB ROLL-OFF ";:INPUT F
160 R3=((0.5*V2)^2)/P1:REM CALCULATES COLLECTOR LOAD
170 PRINT "SELECT BASE-GND RESISTOR VALUE"
180 PRINT "(1K-100K) ";:INPUT R2
190 IC=(0.5*V2)/R3:REM CALCULATES COLLECTOR CURRENT
200 R4=VE/IC:REM CALCULATES EMITTER RESISTOR
210 R4=INT(R4*10+0.5)/10
220 IB=IC/B:REM CALCULATES BASE CURRENT
230 VB=V1+VE:REM CALCULATES VOLTAGE AT BASE
240 VC=VS-(R3*IC):REM CALCULATES COLLECTOR VOLTAGE
250 I2=VB/R2:REM CALCULATES R2 CURRENT
260 I3=I2+IB:REM CALCULATES R1 CURRENT
270 R1=(VS-VB)/I3:REM CALCULATES UPPER BASE RESISTOR
280 Z1=(R2*(B*R4))/(R2+(B*R4)):Z1=INT(Z1):REM CALCULATES INPUT Z
290 Z2=R3/4:Z2=INT(Z2):REM CALCULATES OUTPUT Z
300 X=Z1/4:GOSUB 370
310 C1=C:C1=INT(C1*100)/100:REM INPUT CAPACITOR VALUE
320 X=R4/5:GOSUB 370
330 C2=C:C2=INT(C2*100)/100:REM EMITTER BYPASS CAP VALUE
340 X=Z2/4:GOSUB 370
350 C3=C:C3=INT(C3*100)/100:REM OUTPUT CAPACITOR VALUE
360 GOTO 380
370 C=(0.159*10^6)/(F*X):RETURN
380 G=0.6*B:REM APPROXIMATE CIRCUIT GAIN
390 PRINT CHR$(125):REM CLEAR SCREEN/HOME
400 PRINT "TYPICAL VALUES FOR CLASS-A OPERATION."
410 PRINT :PRINT "TRANSISTOR TYPE IS ";
420 IF T=1 THEN PRINT "SILICON."
430 IF T=2 THEN PRINT "GERMANIUM."
440 PRINT "TRANSISTOR BETA (HFE) = ";B
450 PRINT "PWR SUPPLY (VS) = ";VS;" VOLTS"
460 I=INT(IC*100000+0.5)/100
470 PRINT "COLLECTOR CURRENT (IC) = ";I;" MA"
480 PRINT "MAX PWR DISSIPATED = ";P1;" WATTS"
490 R1=INT(R1)
500 PRINT "R1 (BASE-VS) = ";R1;" OHMS"
510 PRINT "R2 (BASE-GND) = ";R2;" OHMS"
520 R3=INT(R3*10+0.5)/10
530 PRINT "R3 (COL-VS) = ";R3;" OHMS"
540 PRINT "R4 (EMITTER-GND) =";R4;" OHMS"
550 PRINT "LOWEST OPER. FREQ. = ";F;" HZ"
560 PRINT "C1 (INPUT CAP) = ";C1;" UF"
570 PRINT "C2 (EMITTER BYPASS) = ";C2;" UF"
580 PRINT "C3 (OUTPUT CAP) = ";C3;" UF"
590 PRINT "APPROX INPUT Z = ";Z1;" OHMS"
600 PRINT "APPROX OUTPUT Z = ";Z2;" OHMS"
610 PRINT "APPROX CIRCUIT GAIN = ";G
620 VB=INT(VB*100+0.5)/100
630 PRINT "VOLTAGE AT BASE = ";VB;" VOLTS"
640 VC=INT(VC*100+0.5)/100
650 PRINT "VOLTAGE AT COLL = ";VC;" VOLTS"
660 VE=INT(VE*100+0.5)/100
670 PRINT "VOLTAGE AT EMIT = ";VE;" VOLTS"
680 PRINT "TO RUN AGAIN, ENTER 1=Y 2=N ";:INPUT P
690 IF P<>2 THEN RUN
700 PRINT CHR$(125):PRINT :PRINT "          COME AGAIN SOMETIME"
710 PRINT :PRINT :PRINT "          BYE BYE!!!":PRINT :PRINT :PRINT
```

Program listing.

cuit application. Typical transistors—such as 2N2222, 2N4401, 2N2907, and 2N4403—have a maximum power dissipation rating of 310 mW in free air. When properly heat-sinked, the 2N2222 will dissipate up to 1.8 Watts reliably. However, in most applications, the usual "free-air" dissipation is considerably less than 310 mW, allowing the circuit impedance to rise along with a reduced power-supply current drain. An advantage of the computer program is that a variety of circuit conditions may be examined quickly in order to find component values to meet the application requirements.

A value for R2 may be selected in many ways. However, the proper way would be to select it to be approximately twice the value of the desired input impedance. There is no real detriment to selecting an R2 value that is too high except that bias stability may be affected. If R2 is too low, the resulting low-input impedance (Z1) requires more drive power from the preceding circuit. However, the actual ratio of R2 current to base current is not critical as long as bias stability exists. By rule of thumb, current through R2 should be at least 10 times higher than I_B.

The Program

To keep the operator-entered data to a minimum, a few assumptions have been made. The first was to establish an emitter voltage at 10% of the power-supply voltage. Doing so allows the emitter resistor value to rise sufficiently for stable biasing and prevents thermal runaway. Thermal runaway may occur if the emitter-to-ground voltage value is allowed to approach the base-emitter voltage value (0.7 volts for silicon devices).

The second program assumption is that the application transfer gain will be approximately 60% of the device's beta value. The actual transfer gain can be found only by working with actual device curves and/or the h_{ie} parameter.

A third assumption involves the lowest frequency of operation. It is assumed that the reactance of each capacitor in the circuit will be nearly equal to its relative circuit impedance. Capacitor C1 would then have the same reactance as the input impedance at the lowest operating frequency, causing half of the input signal voltage to be dropped across the capacitor. The other half would be dropped across the amplifier's input. Capacitor value determination using this technique provides a calculated rolloff of about 3 dB (half power) or less at the lowest operating frequency.

The program was developed using generalized Basic to allow easy entry into the greatest number of types of computers. In addition, program variables are listed in Table 1, and remark statements are used abundantly within the program to help the user follow through the program steps. ■

Irving M. Gottlieb W6HDM
931 Olive Street
Menlo Park CA 94025

No Free Lunches

The grail of perpetual motion has eluded scientists for thousands of years—are we on the brink of discovery?

Number 6 on your Feedback card

Beyond their practical involvement in technology, hams have very naturally maintained interest in the tenets of science and physics—in particular, those matters relating to the uses of energy. Without the various exploitations and transformations of energy, electricity and electronics would have remained but laboratory curiosities.

It is no wonder, then, that the patent office has long been plagued by alleged inventions of "free lunches"—the on-the-spot creation of energy and its corollary, perpetual motion. Surprisingly, however, this is not the exclusive realm of the ignorant, the irrational, or the scientific illiterate. When one probes beneath the superficialities of this subject, both quacks and eminent physicists are found in the mix. Indeed, there appears to be a gray area between the possible and the impossible wherein "practical" perpetual motion merits consideration even if the academic purist's version is unattainable.

For example, the nuclear derivation of energy from a pound of uranium so greatly exceeds the energy available from the combustion of a pound of coal that it is almost suggestive of magic. Compared to the more familiar energy processes, the nuclear utility station can be viewed as a practical approach to energy creation. Similarly, solar energy conversion systems operate for practical purposes, as if energy were being created.

We know, of course, that the pound of uranium—as well as the sun—must ultimately run down as a direct consequence of releasing its energy. So, even though "true" perpetual motion, or nondepleting energy, must remain a fantasy, untapped abundances in nature lure the adventurous in spirit, and it is not improbable that useful and practical compromises might result from seekers of the free lunch. Such things as fuel cells and vehicles operated from the kinetic energy stored in rapidly rotating flywheels come to mind.

Although the patent office automatically rejects perpetual-motion machines, it would accord an inventor an open-minded evaluation if only he would bring along a *demonstrable model*. A common excuse tendered by the alleged inventor of a perpetual-motion machine is that his prototype is not yet ready for demonstration because certain refinements must be made to eliminate unanticipated friction (see Fig. 1 for an example). How sad and how true! Let's look further into this matter and see what various free-lunch proponents and critics have said and done.

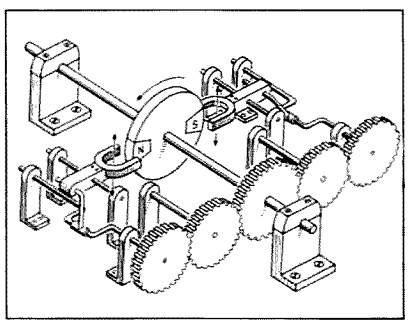


Fig. 1. Hitherto, attempts to secure continuous rotation in motors using only magnets have not been successful. An obstacle has been a condition of latchup wherein the arrangement quickly comes to a standstill after very limited motion. In this invention, a mechanical-feedback system is claimed to prevent such stoppage. The inventor promises to demonstrate such a self-running motor as soon as certain frictional losses can be reduced to a satisfactory level.

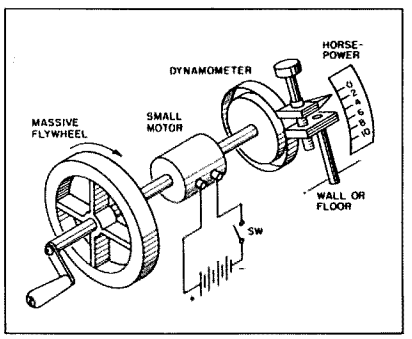


Fig. 2. The "Garabed," an alleged free-energy system. The claim and interpretation were predicated on the following demonstration: 1) The flywheel is manually set in rotation. 2) The switch, SW, is closed, energizing a small motor of 1/25 horsepower or so. 3) Because the small motor supplies frictional losses, the flywheel turns at a constant speed. 4) The dynamometer is adjusted so that the brake lining grips the rotating drum; it is observed that a maximum output indication of about 10 horsepower occurs briefly before the system comes to a halt. 5) Interpretation is made that 1/25 horsepower was multiplied to 10 horsepower as a manifestation of the "free energy" provided by the system. But, momentary high-power does not *mean that the output energy exceeds the total energy imparted to the flywheel.*

Gems of Wisdom From the Experts

A classical defense of the pursuit of perpetual motion and on-the-spot creation of energy stems from the obvious fact that there was once a first-time demonstration of the various inventions we now take for granted. Therefore, declare those who thus remind us of this, there will someday be a first-time demonstration of a perpetual-motion machine! And, though we may refute such statements with logical arguments, our position is likely to be weakened by reminders of past opinions voiced by experts who should have known better.

What makes such reminders particularly embarrassing is that these experts seem to have widely missed the mark in their own field of expertise. When the weatherman or the stockbroker calls the shots incorrectly, we tend to be tolerant and forgiving, but not so when the scientist gives us wrong directions. Yet, it is entirely possible for an expert in any field to cough up erroneous predictions. After all, we forget that whatever notable achievements underlie his fame and recognition, they were reached only after he discarded many mistaken judgments; we shouldn't be harsh with him for advancing just another mistaken judgment.

When Lord Kelvin was president of the Royal Society, he adamantly let it be known that "heavier-than-air flying machines are impossible." And a notable mathematician of the era ground out some elegant equations showing that such an accomplishment was indeed in violation of natural law. It was later found that his analysis also indicated that the bumblebee was incapable of flight. Fortunately, neither the bee nor the Wright brothers were versed in such high mathematics. And then Nobel prize winner Robert Millikan put to rest the hopes of forward-looking physicists by stating: "There is no likelihood

that man will ever tap the power of the atom." Topping both, the 1899 director of the U.S. patent office declared: "Everything that can be invented has been invented."

It obviously behooves us to be tough-minded in demanding proof of a claim that may strike us as far-fetched; at the same time, true open-mindedness is a requisite. Otherwise, it might be to our everlasting embarrassment that we failed to recognize an Edison or an Einstein because of our self-righteous notion of the possible and impossible. Even the charlatans and the self-deluded deserve due consideration; the practice will serve us in good stead when the real McCoy comes along.

The Garabed: Delusion Despite Sincerity

Perpetrators of fraud that many alleged inventors of perpetual motion are, some deserve credit as accomplished magicians; as with the stage magician who saws the pretty girl in half, it just ain't so! Often, there is a concealed colleague-in-crime turning a crank in another room, or there are hidden wires supplying the electrical energy, which seemingly originates from nothing.

Such was not the case with a notable proponent of free energy, Garabed Giragossian. This sincere, but scientifically deluded inventor claimed in 1917 that he had discovered a means of providing humanity with inexhaustible energy instantly available for any purpose. Because he mistrusted the patent office, he requested special protection from Congress instead of filing a patent. With the aid of influential supporters of his claim, the requested protection was granted in 1918 in the form of a public resolution. The resolution, however, was conditional on the premise that the free-energy device had to pass the scrutiny of an appointed commission of engineers and scientists. This it failed to do.

It is particularly interesting to examine the nature of Giragossian's machine, for his mistaken interpretations are commonly made in patent applications, and are continually encountered in basic science classrooms. The Giragossian machine was essentially a massive flywheel coupled to a tiny electric motor (see Fig. 2). The demonstration commenced by having an assistant turn a crank until the flywheel was turning at a respectable rate. Then the motor was turned on. Instead of gradually losing speed and ultimately stopping, the flywheel now proceeded to run continuously at a constant speed. This, of course, was because the tiny electric motor provided just the required power to overcome the frictional and windage losses, which otherwise would have slowly eroded the spinning motion of the flywheel.

So far, so good—no claims were made on this aspect of the machine, which incidentally was called the "Garabed." It was in the next step of the demonstration that this sincere, but miscalculating inventor purported to see evidence of free energy. With the flywheel spinning at a constant rate, he dumped its kinetic energy into a brake-type dynamometer, which briefly indicated about 10 horsepower. The flywheel, of course, quickly

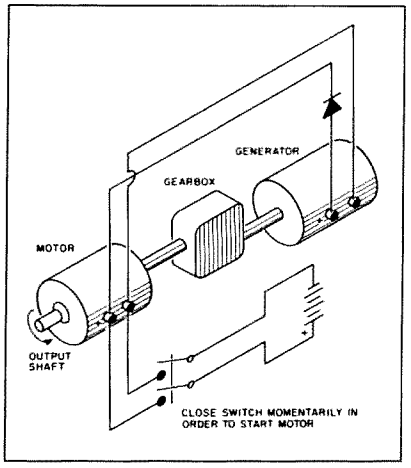


Fig. 3. A representative arrangement of motor-generator perpetual-motion systems. Hopefully, once the motor is operating, its continued operation will be sustained from the output of the generator. The switch, dc source, and the rectifier comprise the startup circuit. Hopefully, too, the gear box ascertains that the motor will be able to drive the generator fast enough to develop high output from the generator.

came to a standstill, having dissipated its energy into the frictional brake of the dynamometer. Giragossian's interpretation was that the Garabed had multiplied the output of the fractional horsepower motor to 10 horsepower.

High Power Does Not Always Imply High Energy

Where did the fervent and sincere Giragossian err? It was simply his inability to distinguish between energy and power. Most certainly, he did succeed in stepping up available power, which is the *rate of using energy*. We can do the same thing in charging a large capacitor from a low-power source of direct current. If we allow sufficient time for the capacitor to charge fully, a very powerful, but short-duration discharge can be produced by shorting its terminals.

Such a miniature lightning stroke does indeed develop more heat, light, sound, and air ionization (that is, more *power*) than might be had by shorting the terminals of the dc supply. Unfortunately, however, the charged capacitor is an inferior supplier of *energy* compared to the dc supply. As a matter of fact, it always turns out that about one-half of the energy supplied during charging is dissipated in whatever resistance may be involved in the charging circuit.

The manifestation of high power by itself does not suffice to identify it as a source of high energy; what may be lacking is the capability of delivering high power over an *extended period of time*. Both the capacitor and Giragossan's flywheel fail in this respect because they quickly lose their power-generating feature.

Another version of Giragossian's approach to the free lunch involves an electric motor

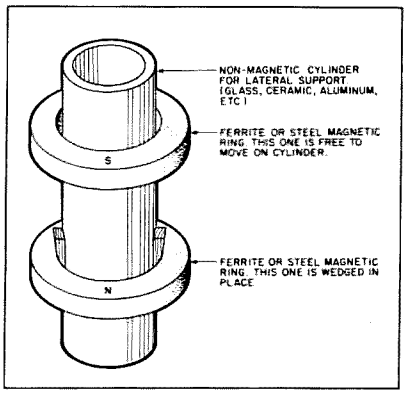


Fig. 4. A "food-for-thought" experiment. No external energy supply is needed for the levitated ring. The upper ring remains levitated indefinitely; neither ring looses magnetic strength. The constant repulsive force from the north poles of the magnetic rings overcomes gravity. If this experiment were simulated by electromagnets, it is obvious that electrical energy would have to be supplied (but only to overcome Ohmic resistance).

and generator system in which the motor is supposed to drive the generator, which in turn powers the motor, which in turn drives the generator, etc. Not only is it hoped that the system will sustain its own operation, but it is supposed to also deliver useful work to the external environment.

Sometimes elaborate gear trains are imposed between motor and generator so that the increased speed of the generator will suffice to overcome frictional losses. But, no matter how such inventors fool around, they ultimately find they cannot fool nature and her immutable laws. In simple language, the energy output of a machine is always less than the energy input.

It is truly remarkable how much energy pursuers of the free lunch will expend to defeat nature's energy law. Before the electrical age, the popular approach to perpetual motion was some manner of unbalanced wheel; in the process of turning, a wheel would somehow experience continual disturbances in weight acting around its rim so that a turning torque was continually applied (see Fig. 3). No contraption of this kind ever remained in sustained motion. Indeed, the more mechanical sophistications applied, the more inherent friction was incurred and the quicker the wheel ground to its inevitable halt!

Mad Inventors or Optimists?

It is always profitable to try to see the other fellow's point of view. What motivates the seeker of the free lunch? Aside from the hoaxer, it turns out that this field may indeed be worthy of study, effort, and experimentation.

Consider, for example, some means of liberating the energy of atomic nuclei that does not also liberate a host of radioactive isotopes, as happens in nuclear fision. Such an accomplishment would make available

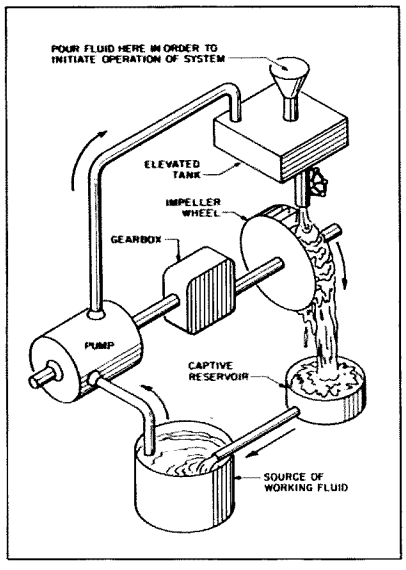


Fig. 5. Basic theme of many hydraulic perpetual-motion systems. Operation of a closed-cycle system is supposed to be self-sustained after initial startup. The gear box represents inventor's attempt to obtain more vigorous pumping action, thereby "fooling" the system to overcome its losses.

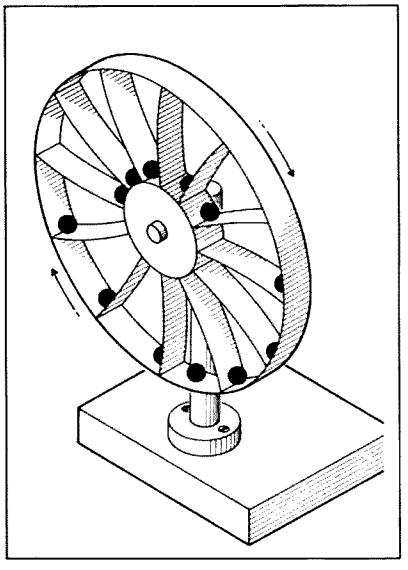


Fig. 6. Perpetual-motion wheel for providing free energy from gravity. This is a typical application of the unbalanced or over-balanced wheel. The radius arm of the steel balls is supposed to shift in such a manner as to keep the wheel turning.

tremendous amounts of usable energy in a relatively clean process.

This is exactly what is being sought in the fusion-technique experiments presently being carried out. If they are successful, it will be possible to extract much of the world's energy from sea water. From a practical standpoint, such an accomplishment will certainly be an *almost*-free lunch. Who knows, perhaps some obscure inventor may come up with an alternate, but simpler means of bringing about fusion than the elaborate systems presently being investigated by teams of eminent scientists?

It is understandable that would-be inventors of nearly free-lunch machines might be misled by statements of definitions commonly found in technological texts. For example, the formula Efficiency = Output Power/(Input Power + Losses) is usually OK in the context in which it is used. It might, however, be better to replace the word power with "energy," in which case there could be no misinterpretation. The possible trouble with the power equation is that it does not involve *time*, as does energy. This allows one to deal with a hypothetical system or machine in which a large peak, or short-duration power, is available at the output, thereby creating the illusion that the operation exceeds 100%.

The Lure of Magnets

Magnets and magnetism have long exerted an irresistible mystique for the pursuers of inexhaustible energy or motion. Indeed, several simple manifestations of magnetism are not easily explained to the satisfaction of those who purport to see possibilities beyond already attained achievements. An electric generator delivers electrical energy as a consequence of the mechanical energy used in turning it. However, the intermediary function of magnetism is bothersome to some; particularly intriguing is the fact that a permanent magnet in a simple dc generator does not "run down." To those who think in this manner, the electrical energy seemingly is provided by the magnetic field, and the mechanical energy input to the generator just happens to be one way of extracting this energy via our crude technology.

Another aspect of magnetic behavior is the observation that a steel ball or roller will be drawn to a magnet, often with great force at the time of actual impact. Why, then, not arrange a circular pattern of magnets and rotating members to produce continuous rotation—a magnetic motor, so to speak? This turns out to be a real brain teaser, for no matter how the scheme is implemented, the rotational motion is short-lived. Obviously, something must be done at the instant of lockup in order to enable further rotation. But what?

Surprisingly, the publishers of *Science & Mechanics*, generally an excellent treatise on technology, featured on the cover of their Spring 1980 edition an artist's rendition of a remarkable home power-plant utilizing a 15-horsepower "magnetic motor" to drive a 5,000-Watt generator. The inventor actually received a patent for the underlying principle. Yet, such an scheme seems to violate fundamental precepts of physics, thermodynamics, and energy conservation. Were such a scheme and such a machine actually feasible, all aspects of modern civilization would undergo an instantaneous quantum jump in global living standards, the like of which has not yet been experienced or even imagined.

Finally, those who try to coax magic out of magnets are intrigued by the phenomenon of levitation. Put two magnetized rings of ferromagnetic material on a supportive rod of nonmagnetic material and, providing the fields are in opposition, one ring will remain indefinitely levitated above the other (see Fig. 4).

The classical explanation is that this is no big deal—no motion is involved, so no work is being done. However, the fact that the force of gravity is overcome by the interaction of the two fields points to a possible free lunch for those so inclined to see things that way. Here, the question as to why the magnetism is not depleted by the continuous "effort" may not engender a soul-satisfying answer.

Closed-Cycle Fluid Systems

The observation that falling water can pack a wallop harks back to an era when artificially kindled fire and the wheel were high technology. Not long after Archimedes invented a means of pumping water from a lower to a higher elevation, it was only natural for him to rig up a system that was supposed to operate in a self-sustaining manner. His scheme comprised the pump mechanically coupled to a water wheel. The pump was supposed to transport water to a higher level, whereupon it was allowed to fall on the water wheel, which then kept the pump going, as well as the entire system—it was hoped (see Fig. 5). But there was no cry of "Eureka!" for the contraption utterly frustrated this otherwise great intellect.

To give credit where due, Archimedes did devise a clever pump for his day. This consisted of a pipe in the shape of a helix. Dipping one end of the helix into a vessel of water and turning it would pump water to a higher level. Today, would-be inventors continue to repeat Archimedes' failed experiment using more sophisticated pumps, modern water wheels, gear boxes, and other components calculated to help fool nature. None, however, has yet been heard to exclaim, "Eureka!"

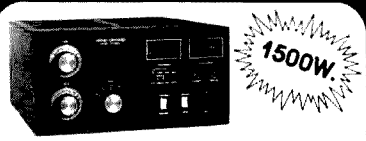
Unbalanced Wheels

If you spin the front wheel of an upside-down bicycle, the long duration of rotation can easily exceed expectation. What we have here is a finely balanced wheel pivoted on inordinately low friction bearings. Observations of this kind have long inspired seekers of perpetual motion to try to add some gimmick to such a wheel in order to enable it to turn indefinitely. The popular approach is to induce unbalance in such a way as to continually apply turning torque to the spokes or rim of such a wheel (see Fig. 6 for one example).

Much ingenuity has been displayed in such endeavors; yet each and every perpetual-motion wheel thus far built has disappointingly failed to make its inventor rich and famous. Indeed, a new law of nature has been suggested by such endeavors: The more elaborate the scheme for automatically unbalancing the tuning wheel, the more quickly it grinds to its inevitable halt!

Although planets spin for eons and electrons apparently spin forever, wheels all too quickly respond to the dissipative effect of

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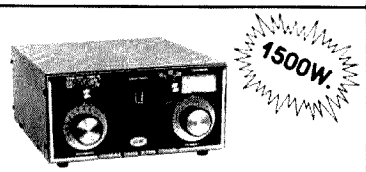
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friction. And sadly, even if all frictional forces could be eliminated, the spinning wheels could only give back the energy imparted to it when it was set in motion.

New Ideas and Oft Repeated Pitfalls

It is not enough to identify a source of energy and attempt to make it do useful work. Energy confers no benefit to us unless it is *available*. A warm mass of metal does indeed contain heat energy. But, such heat energy will not of its own accord flow to a hotter mass of metal. It is much like expecting a ball to roll uphill. If, however, the inventor arranges his apparatus so that there can be a flow of heat energy from a hot to a cold body, he is on the right track and may well come up with a new and useful machine or energy-conservation technique.

A stumbling block often overlooked by the enthusiastic would-be inventor is the nature of chemical reactions. All chemical reactions tend toward a stage of equilibrium wherein the reaction stops. When the equilibrium is attained quickly, you have the ingredients for an explosion; slower reactions enable such devices as batteries to be useful. A corollary of the equilibrium process is that the initial chemicals get "used up" or change their status in such a way as to be ultimately no longer available for providing energy. Thus, electric cells must be either replaced or recharged after a time.

Combustion, too, delivers just so much energy from the chemical fuels. Along with perpetual-motion machines, patents are often sought for alleged 400-mile-per-gallon carburetors. Of course, the bottom line to such inventions is that the major oil companies buy them up and keep them off the market! Although improved carburetors and fuel injectors constantly squeeze more efficiency from automobiles as the years go by, you can bet your boots that outlandish claims can be taken with a grain of salt.

Speaking of chemical reactions and automobiles, a continually "reinvented" panacea for the expense of fueling the automobile involves a hydrogen-operated engine in which the hydrogen is indirectly created by the engine itself. The basic idea is to have the engine drive a generator, which provides electric power to free hydrogen from water by electrolysis. So, you collect the hydrogen and burn it in the engine, which hopefully provides both motive power and the power to turn the generator.

Electrical and chemical systems are often manipulated by would-be inventors who would have the everyday horse sense not to pursue an analogous goal via a mechanical system. Thus, wheels with hinged weights to keep them forever in motion may loom up as obviously ridiculous. But in electrical and chemical systems, the link between cause and hoped-for effect is invisible or less obvious; a would-be inventor may become hoodwinked by the apparent sophistication of his violation of nature's laws. Not even the microprocessor or computer can be successfully deployed to fool nature. So, if the system in its most primitive form cannnot lift itself by its bootstraps, there is nothing to be gained from a program instructing it to do so.

Some Open-Minded Conclusions

If the would-be inventor's quest is not perpetual motion or free energy, but more bang for the buck, it is less easy to try to accuse him of chasing a pipe dream. For then, he can justifiably maintain that he is working in the realm of the possible and the practical. Consider such processes and techniques as geothermal sources of electric power, fuel-cell energy systems, and solar and wind electrical sources. These are all capable of providing "cheap lunches" in the quest for abundantly available energy. Moreover, they are not blue-sky projects; successful applications already exist and are giving good account of themselves.

In both technology and science, there are activities that resemble ordinary notions of perpetual motion or free energy, but upon closer scrutiny are found to either abide by natural laws of energy conservation or are more hypothesis than fact. For example, a resonant circuit cooled to near-zero temperature will oscillate indefinitely, or almost so.

But can energy be extracted from such a "tank"? It is indeed easy enough to tap such an energy source, but in so doing, the available energy will be depleted. This happens every time instrumentation is applied to ascertain that oscillation still exists. Therefore, such a cryrogenic resonant circuit, far from being a free-lunch energy source, is nothing more than a sophisticated storage system—like a battery, charged capacitor, or tank of water, it does not automatically replenish what it gives up.

In science, there is the hypothesis that the near vacuum of intergalactic space is not as benign as once supposed. Rather, energy can apparently arise from such apparent "nothingness." The reasoning underlying such "far-out" theorizing is more mathematical and esoteric than practical. The harnessing of such a cosmological source of energy probably had best be left to the Buck Rogers and Superman scenarios of space-age science, unless you are prepared to *demonstrate* your working model to the skeptics in the patent office.

Science, itself, is in a dilemma regarding the absolute integrity of the conservation of energy in the universe at large. Right now, effort is being expended trying to learn whether the proton of atoms has an infinite life span, or whether it, too, ultimately decays. In the meantime, there is little communication to the non-scientist bold enough to ask such questions as why the elementary particles of physics, such as the electron, spin without letup. Instead of holding their breath until really satisfying explanations of such enigmas are forthcoming, inspired inventors will continue their quest for unconventional energy sources. And, the smart ones will diplomatically refrain from presenting "free-energy" systems or "perpetual-motion" machines to the patent office—less friction will be provoked through the use of other words and phrases. ■

Paul C. Bunnell KE6VK
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Subaudible Snooping

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The VHF and UHF amateur bands are filling up with repeaters, and many repeater owners are finding it necessary to require the use of subaudible tone encoders to access their repeaters. The design presented here is a counter which, when connected to a receiver, will display the frequency of the subaudible tone used by the transmitting station. Several special circuits have been designed into the counter to provide proper filtering of the desired tone and to allow a frequency resolution of 0.1 Hz in a counting interval of only 0.2 seconds.

The typical frequency range of subaudible tones is 67.0 Hz to 250.0 Hz, with an FM deviation of 0.5 kHz or less. This low value of deviation means that unwanted signals with higher deviations, such as speech, must be rejected. Also, the point at which the receiver audio is obtained must be prior to the low-frequency filters in the audio amplifiers to avoid unwanted rolloff.

Parts List

Value	Description	Vendor	P/N	Qty.	Price
0.01 uF	Mylar	Jameco	MY.01/100	2	$ .54
0.001	Mylar	Jameco	MY.001/100	2	.24
4–34 pF	Ceramic	Jameco	TC 4–34	1	.75
1 uF	Film	Jameco	P4537	4	2.64
22 uF, 16 V	Elect.	Digi-Key	P6024	1	.14
100 uF, 16 V	Elect.	Jameco	R100/16	2	.42
U1–U4	TIL311	Jameco		4	43.80
U7–U10	74C160	Jameco		4	4.76
U11	74LS74	Jameco		1	.39
U17	TL084	KCS		1	1.40
U13	CD4060	Jameco		1	.89
U14, U15	CD4518	Jameco		2	1.98
U12	CD4011	Jameco		1	.29
U16	CD4046	Jameco		1	.89
U18	MF10CN	Digi-Key		1	3.75
U6	7808	Jameco		1	.79
U5	7805	Jameco		1	.79
3.2768 MHz	Crystal	Digi-Key		1	1.62
4.7 Meg, 1/4 Watt		Jameco		1	.06
1.0k, 1/4 Watt		Jameco		4	.24
1.8k, 1/4 Watt		Jameco		3	.18
68k, 1/4 Watt		Jameco		1	.06
270k, 1/4 Watt		Jameco		1	.06
390k, 1/4 Watt		Jameco		1	.06
100k, 1/4 Watt		Jameco		4	.24
1.5k, 1/4 Watt		Jameco		2	.12
12k, 1/4 Watt		Jameco		2	.12
1.2k, 1/4 Watt		Jameco		3	.18
2.2 Meg, 1/4 Watt		Jameco		1	.06
47k, 1/4 Watt		Jameco		1	.06
180k, 1/4 Watt		Jameco		2	.12
1.8k, 1/4 Watt		Jameco		1	.06
82k, 1/4 Watt		Jameco		1	.06
6.8k, 1/4 Watt		Jameco		1	.06
100 Ohm, 1/4 Watt		Jameco		1	.06
390 Ohm, 1/4 Watt		Jameco		1	.06
					$67.94

Sources of supply: KCS Electronics, 1043 North Stadem Drive, Tempe AZ 85281; Digi-Key Corp., PO Box 677, Thief River Falls MN 56701; and Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002.

Circuit Design

A block diagram of the counter is shown in Fig. 1. The input frequency is passed through a low-pass filter, a tunable bandpass filter, and then into a phase-locked loop consisting of a phase detector, voltage-controlled oscillator (vco), and frequency divider. The vco generates a frequency 100 times the input frequency, and this signal is used to tune the bandpass filter. The 100f frequency is then divided by two and used as the input to the counter. The counter time base allows the counter to count for 0.2 seconds, latches the result into the display, and resets the counter for the next counting interval. Counting a 50f frequency for 0.2 seconds results in a displayed frequency of 10f and, by moving the decimal point one digit to the left, we can display the frequency f with a resolution of 0.1 Hz.

Fig. 2 is the detailed circuit diagram. The audio enters at the input to U17A, which presents a high input impedance to the receiver and a low output impedance to drive the low-pass filter. U17B and U17C form a low-pass filter with a cutoff frequency of 300 Hz to provide rejection to speech. The bandpass filter, U18, is placed between the two low-pass sections and tunes itself to 1/100th of the frequency of the vco, automatically centering the filter at the desired frequency. The final amplifier section, U17D, is connected as a comparator.

U16 contains both the vco and the phase detector, and the frequency dividers are in U15. Up to this point in the circuit, the ICs all run from a regulated 8 volts from U6. Since the rest of the circuit operates at 5 volts, a level shifter using 1k and 1.8k resistors is necessary for proper interface. The time-base generator, U13, uses a 3.2768-MHz crystal and divides it down to 200 Hz. Another divider, U14, divides the 200 Hz down by 40, resulting in a timing period of 0.2 seconds. The function of U11A and U12 is to cause the display to update after 0.2 seconds, reset the counters (U7–U10), and reset the time-base divider chain (U13, U14).

The main counter chain is U7–U10, and it connects directly to the display ICs, U1–U4. The displays also contain integral latches and decoders as well as provisions for blanking and lighting decimal points. The left-hand decimal point on U4 is wired to be continuously on. The rest of the decimal points are wired to the output of U11B, which acts like a lock detector. When the phase-locked loop is out of lock, U11B will cause the decimal points to turn on or flash.

Operation

The Q of the bandpass filter (47) and the phase-locked-loop filter time constants were determined experimentally by trying to minimize lockup time and maximize rejection of voice modulation. The bandpass filter Q should be high to provide filtering, but low enough to allow some signal to the phase-locked loop when it is not locked. The present design locks up in about one second if the level of the subaudible tone is 0.5-kHz deviation. Do not be surprised if the display reads 120.0 Hz on stations with poorly filtered power supplies.

Interfacing and Adjustment

The time base may be measured in one of several ways. If a counter is available that will measure period, it can be connected to U14, pin 13 and the variable capacitor adjusted for .200000 seconds. Pin 12 of U11B should be grounded during this measurement. Another alignment method is to measure the frequency of the crystal at U12A, pin 10 and to adjust the frequency to 3.276800 MHz.

The power requirements are 12–14 volts at about 360 mA. Both voltage regulators should be mounted to a heat sink of four to six square inches to provide adequate cooling.

The audio connection to the receiver should be at the discriminator output or possibly just before the volume-control pot. Inspect the circuit carefully for circuits that would roll off the low-frequency response and connect the audio pickup ahead of these filters. Next, connect an oscilloscope to pin 2 of U18 and note if any limiting takes place when normal speech is received. The proper audio level is that which causes just occasional limiting on audio peaks. If the gain needs to be adjusted, change the value of the 100k resistor connected between pins 6 and 7 of U17A. More gain requires a higher value; a lower value will reduce the gain.

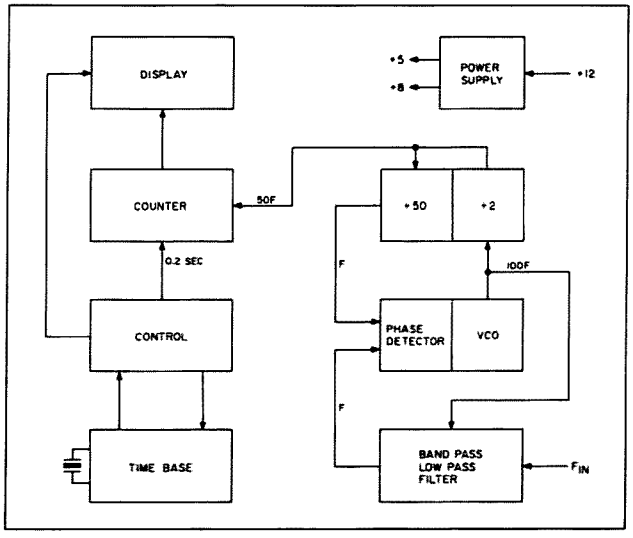


Fig. 1. Block diagram.

Conclusion

This subaudible tone counter will allow you to make on-the-air measurements of the tone frequency of a transmitting station. If the signal you are receiving is the output of a repeater, bear in mind that most repeaters will roll off the low frequencies and not retransmit them. The best results will be obtained if the station can be received directly. ■

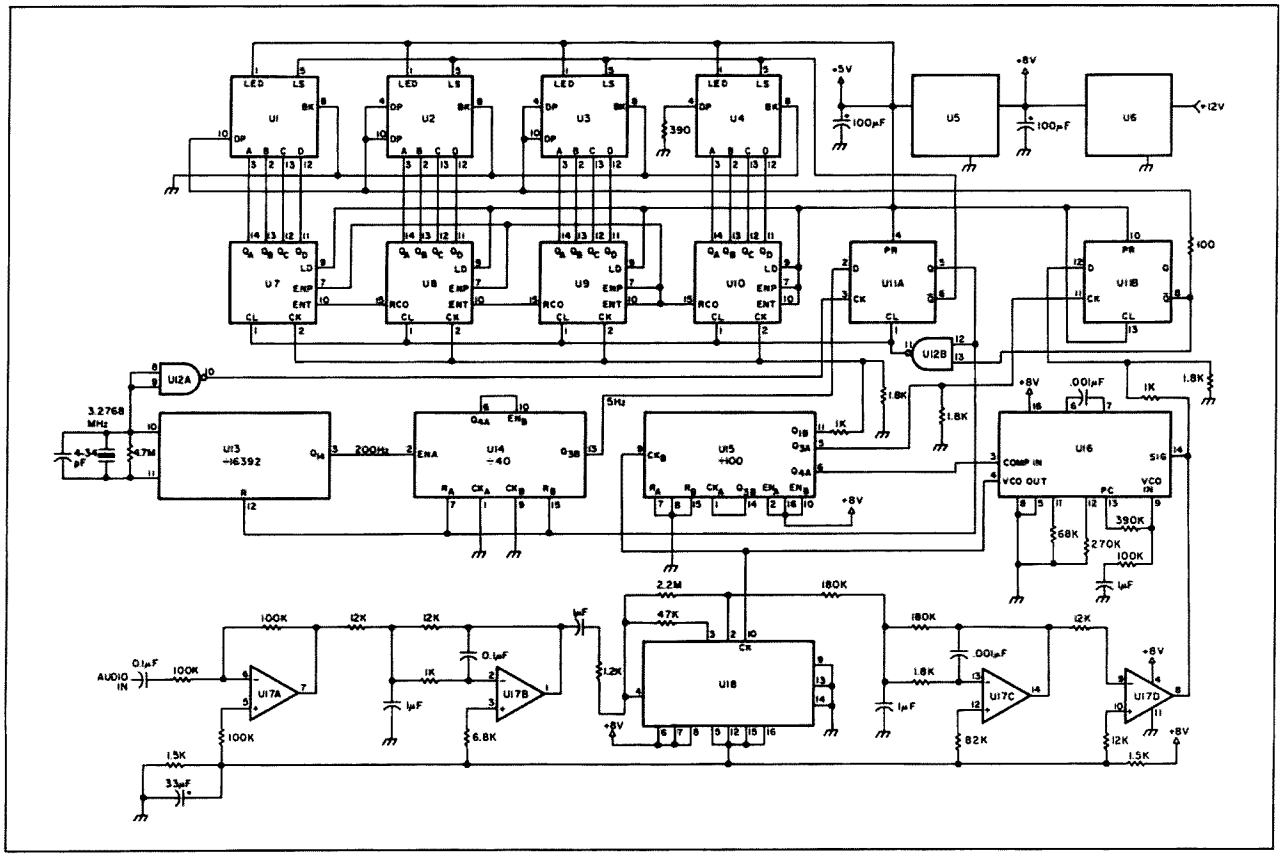


Fig. 2. Circuit diagram.

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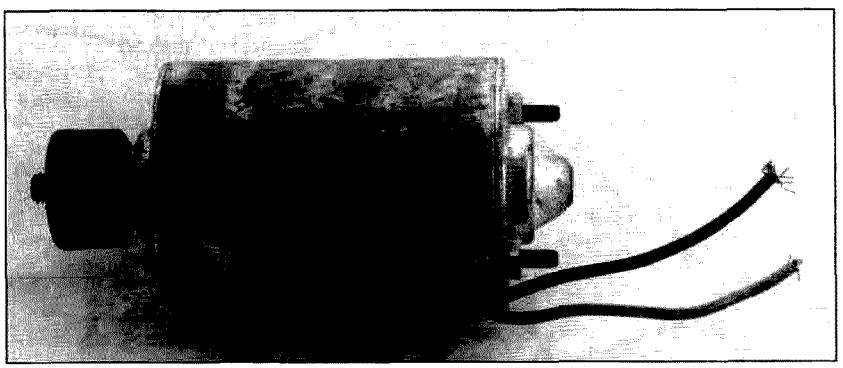


Photo A. The 1/10-horsepower, 12-V-dc bicycle pedal-assist motor.

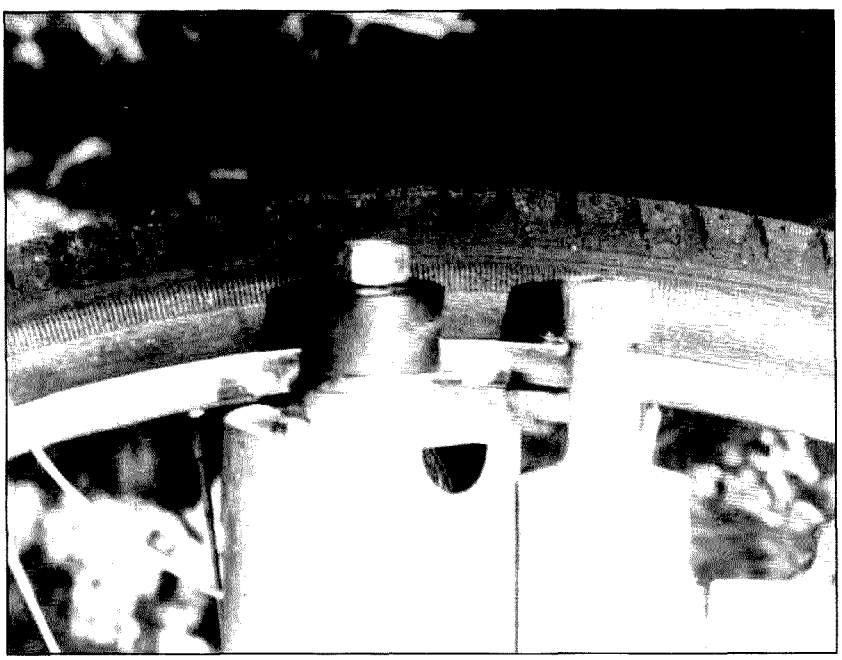


Photo B. The motor with the home-brew friction roller mounted against the bicycle tire rim. The smaller roller is the regular bicycle headlight generator.

Do you need an inexpensive source of 12-volt auxiliary power for emergency use, camping out, Field Day, and the like? I did, and I wanted to use my bicycle to generate the power. Regular automotive alternators were too heavy, cumbersome, and hard to crank using a bike. What I needed was something that would provide a steady 10 or 15 Watts for operating QRP or that could charge up a small lawn-tractor or motorcycle battery. I needed something that would run with a relatively easy cranking or pedaling effort, not the gut-busting level needed to keep a 50-Amp alternator turning. I remembered W2DNZ's stories about trying to keep a 100-Watt transmitter on the air with a bicycle-driven alternator with no battery backup. This sounded like a great way to get in shape for running the Boston Marathon wearing weights, or pedaling the *Gossamer Albatross* across the Atlantic with a stiff head wind, but not much fun for the weekend ham!

"There is no good reason I can see why this same approach wouldn't also work with small windmills, water wheels, etc. for other low-power installations."

How about the little ac generators that are commonly sold to run bicycle headlights? Some of the survivalist books recommend them as a source of power, mostly because they are so widely available. The inexpensive ones, though, provide only 6 to 8 volts for a few Watts—better than nothing at all but not very useful. Using a voltage doubler or even

tripler right off the ac generator might deliver enough voltage to charge up a stack of NiCd penlight cells to power an HT or small QRP rig, but at only a few mils of current it would take an awful lot of pedaling.

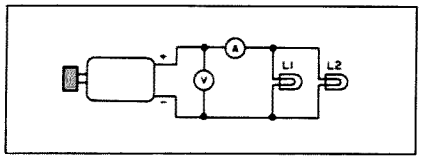


Fig. 1. Circuit used in the first test run.

What I needed was a compromise, something with more power than a bicycle generator, but not as big as a heavy-duty auto or truck alternator. Two possibilities suggested themselves: either a small alternator from a lawn tractor, snowmobile, or outboard motor, or a permanent-magnet dc motor running backwards as a generator. The small alternators seemed almost ideal, but availability and price were a problem. Also, they tended to have unusual gear or belt-driven hardware, and they required a battery backup for the field current. I looked at automotive windshield washer motors, but they were cumbersome because of their right-angle worm-gear drives.

The Motor

After much searching, I settled on a 1/10-horsepower, 12-V-dc, permanent-magnet motor manufactured by Bosch. It is a pedal-assist motor for bicycles and electric mopeds, though it also has wide applications in things like wheelchairs and hobby robots. This particular one was purchased for five dollars at a hamfest flea market, but the same or similar motors regularly are listed in the surplus catalogs of companies like Etco, Meshna, Fair Radio, Herbach & Rademan, and several others, usually for prices in the ten-dollar-and-under category.

The motor is built in a cylindrical case about four inches long and two and a half inches in diameter. Power is provided through a 5/16" threaded shaft 3/4" long at one end. The positive and negative leads are both isolated from the case and are brought out through an opening on the side. The rotation of the armature is reversible with the polarity of the applied dc.

A friction roller was made from a 1-1/4" diameter cylinder of hard rubber about 3/4" thick. This happened to be available as a rubber foot on a piece of surplus medical electronic equipment, but any small rubber roller would do. Another good possibility would be a small grinding wheel of the sort sold for electric drills, though this might tend to wear the bicycle tire out after a while. If this generator setup is to be used with a stationary bicycle (as opposed to one that can be ridden) then the rear wheel tire and tube should be removed, a small diameter pulley mounted on the motor shaft, and the armature belt-driven off the wheel rim. Another possibility would be a small-diameter chain sprocket driving a 2:1 or 3:1 surplus step-up reduction gear.

With the friction drive arrangement I used, the gears on the bike were set at their highest speed; the rear wheel was turning approximately four revolutions for every turn of the pedals. Adding in the diameter ratio between the 26" rear tire and the 1-1/4" friction wheel, the total turn ratio was on the order of 80:1. This meant that when the pedals were turned at a steady 40 or 50 rpm, the armature was spinning in the vicinity of 3,500 to 4,000 rpm, which is about the same speed that the armature runs when it is lightly loaded as a 12-V-dc motor.

The setup for the first test run is shown in Fig. 1. Automotive taillight bulbs were used as a load, with the filaments hooked up in parallel. An ammeter was placed in series with the load, and a voltmeter across it. The mechanical resistance of the generator was strong enough so that output varied considerably from one part of the pedal stroke to another. This is no problem with the bicycle actually in motion, as the inertia of the bike and rider is adequate to smooth things out. On a test stand, though, it is hard to get a steady enough output to read the meters (see Fig. 2).

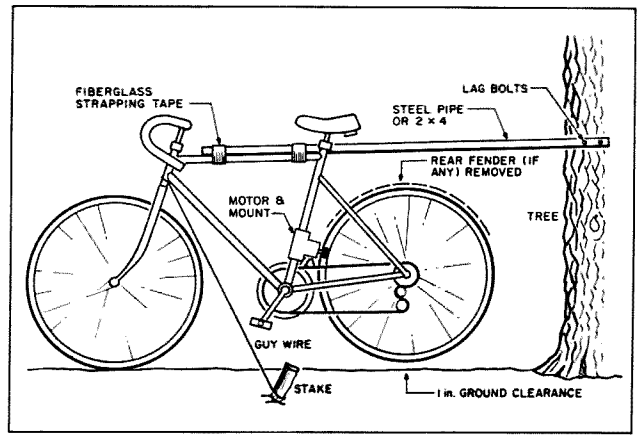


Fig. 2. The test stand. You may want to find a jockey to do the pedaling.

The circuit in Fig. 3 was then tried. A couple of 2,200-uF capacitors were put in parallel with the armature and the load. The capacitance acted as an electrical flywheel and also raised the average output voltage somewhat. By really cranking hard on the pedals, a peak output of about 3.5 to 3.8 Amps at just a tad under 12 volts was the best that could be sustained. For most low-power ham operations, 30 or 40 Watts at 12 volts is adequate, and if the average load can be scaled back to hold the generator output around 3 Amps, at the 30–35-Watt level, a comfortable rate of pedaling can be sustained—about the same effort as riding on level pavement.

However, 11.9 to 12.1 volts is just a little too low for charging up a 12-volt standby battery. A nominal 12-volt lead-acid battery needs around 13 volts or better for recharge, even more if a blocking diode is used. At-

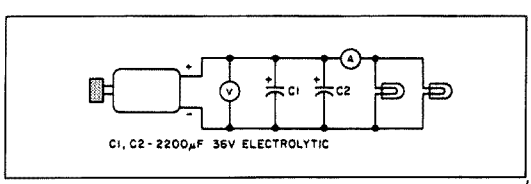


Fig. 3. Modified test circuit, with two 2,200-uF capacitors in parallel with the armature and the load.

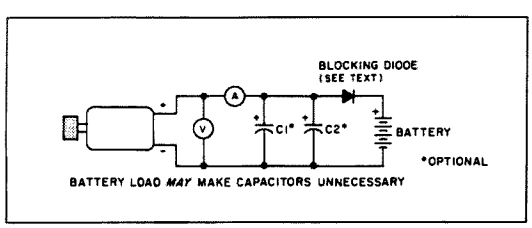


Fig. 4. Substitute a germanium diode for the silicon one and you can save a half volt or more because of the lower forward voltage drop.

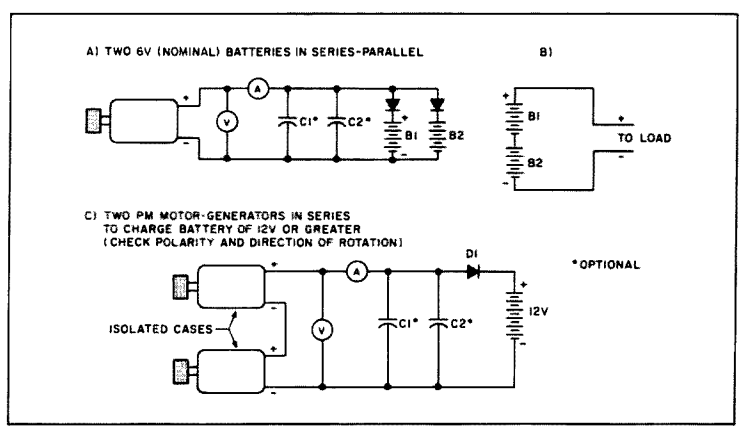


Fig. 5. (a) Two 6-V batteries in parallel while being recharged and (b) switched to series while in use. (c) Two motor generators in series.

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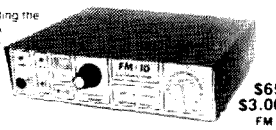
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tempts to get the voltage up by cranking the pedals harder or reducing the load were not very successful; there was a definite "peaking out" effect around 12 volts. This was either because the windings and core of the armature were becoming saturated, or because the mechanical load resistance was causing the friction wheel to start slipping, or some combination of both.

A blocking diode is usually desirable when you're trying to recharge a battery; without one current will tend to flow back through the windings from the battery, and the generator will start acting like a motor again. The forward series voltage drop of the junction, usually on the order of 1.7 to 1.8 volts for a silicon diode, adds to the necessary voltage that must be provided by the generator to yield any meaningful amount of charging current. Taking a trick from the solar-cell people allows us to minimize this: Substitute a germanium diode for the silicon one and you can save a half volt or more because of the lower forward voltage drop. One junction of a germanium bipolar power transistor, such as the audio transistors used in many automotive broadcast radios in the late 50s, will do as well and will probably be easier to come up with in the station junk box (see Fig. 4).

If a 6–10-volt battery is adequate for your QRP and emergency power needs, this setup will be fine as is. If you really need a full 12 volts, you must resort to sneaky techniques. One possibility is to use a pair of motors as generators and put their outputs in series. If you try this, you must be careful to observe the correct polarity of output and direction of armature rotation. Also, be sure that both leads of the motors you are using are isolated from the case. If they aren't, some kind of insulated mount must be used. You may also find that two motors and two sets of friction drive rollers put a much heavier mechanical resistance on the pedals, and the output you can sustain at a comfortable level of pedaling effort may be reduced substantially—see Fig. 5(c).

A good compromise for many Field Day operations would be the arrangement shown in Fig. 5. Two 6-volt motorcycle or Gel-Cell type batteries are placed in parallel while being recharged, but are then switched to series to provide 12 volts while in use. The most practical arrangement would be to have four 6-volt batteries or banks of cells, so that one pair is always available to power the rig while the other is being charged up. Two blocking diodes act as load dividers to help maintain even charging rates in both banks of cells. If both banks have an identical internal resistance and are kept at the same charge level at all times, a single diode would be adequate.

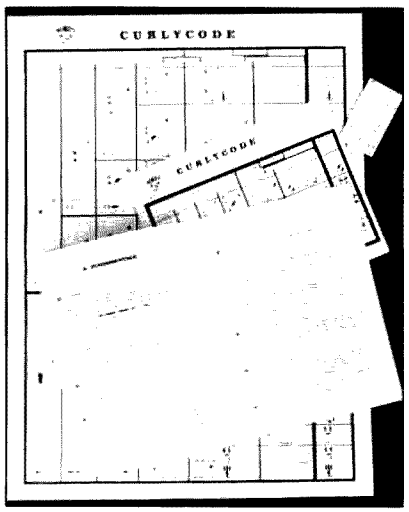
There is no good reason I can see why this same approach wouldn't also work with small windmills, water wheels, etc. for other low-power installations. For the *truly lazy*, use a small gasoline moped or string-trimmer engine, thereby creating Putt-Putt Propulsion for the Pedal-Pushing Power Plant. ■

Holiday Buying Guide

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Curlycode from Mind's Eye Publications.

MIND'S EYE CURLYCODE

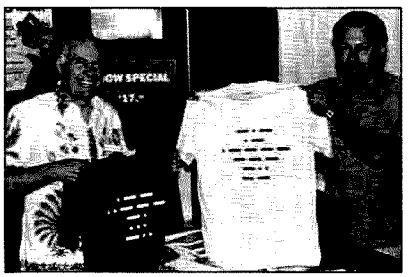
An unusual method for learning Morse code using rhythms and shapes is available from Mind's Eye Publications. Curlycode is a course designed either to teach code or to improve your code speed. The Curlycode system combines the rhythms of Morse code into shapes that are easily remembered; as you trace the shape you are tracing the outline of the letter being sent.

The basic Curlycode system costs $6.50, or $11.50 for the deluxe version, which includes wall charts and a handy pocket guide. Ten complete sets may be purchased at the discount rate of $91.50 including postage. For more information, check Reader Service number 252.

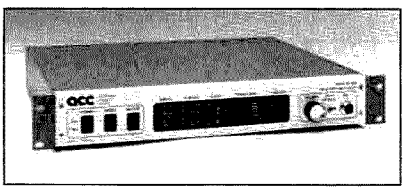
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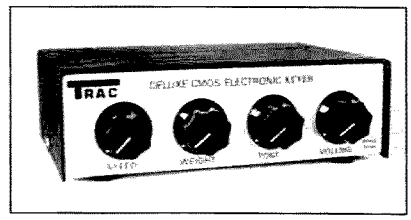
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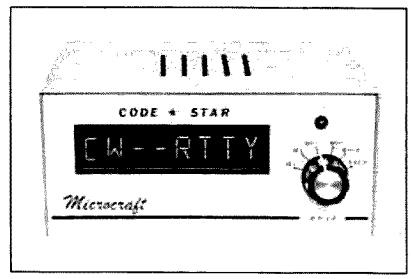
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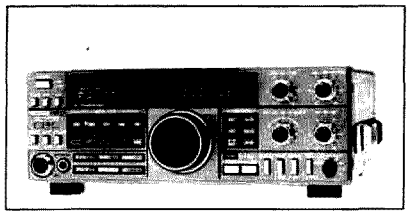
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The MFJ-949C Versa Tuner II.



Kenwood's TS-440S.

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TS-440S

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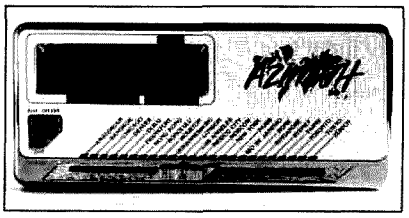
R-5000

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Azimuth's WT-80 World Time Clock.

AZIMUTH WORLD CLOCK

Azimuth Communication's new WT-80 World Time Clock features digital readouts with both local time and world time in a 24-hour format. The quartz clock operates from a single oscillator and uses a 24-position slide switch to show the time in 24 cities around the globe (UTC is displayed when London is selected). The clock also includes a button-operated light and a snooze alarm.

For more details, check Reader Service number 260.

WENZEL COUNTER-MATE

The Wenzel Counter-Mate is a personal frequency standard which provides stable 1- and 10-MHz signals to calibrate frequency counters. A third-overtone 10-MHz crystal mounted in a proportionally controlled copper oven is used for very low drift. Outputs will drive both TTL and 50-Ohm loads with a 5-ns rise/fall time square wave.

To get more information on the Wenzel Counter-Mate, check Reader Service number 261.

MJC TECHNOLOGIES SCORE

The Sweepstakes Contest Operating Results Enhancer is billed as the ultimate ARRL Sweepstakes contesting system. The software, which runs on the IBM PC and compatibles, handles all of the logging and duping tasks associated with the contest. In addition, SCORE will directly control the Heath SS-9000 transceiver and Pro-Search rotor controls; frequency and antenna direction are automatically entered into the log.

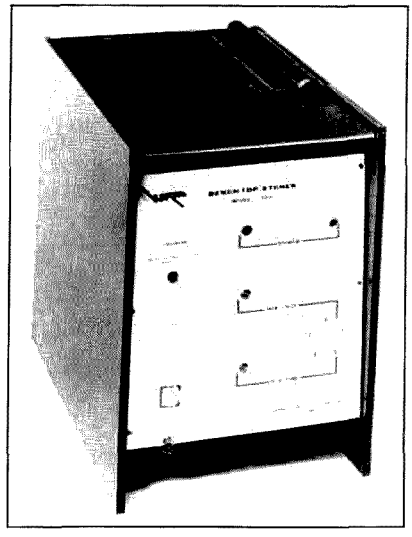
Real-time scoring information is displayed along with sections worked/needed. A variety of reports can be generated, including a complete log in callsign or contact order; a section-contact report, which lists the number of contacts for each ARRL section and the log information for the first contact in each section; an operating profile, which graphically displays band changes, QSO rates, and off periods; and a contest summary (required for Sweepstakes entries).

Demo disks are available to qualified clubs; for more details, please check Reader Service number 262.

TEXAS MAGNETICS

Texas Magnetics Corporation, the largest U.S. supplier of magnetic base assemblies for mobile antennas, is celebrating their 10th anniversary this year. TMC also manufactures Magna-Grab magnetic tool racks in two sizes; the TMC-100 is 13" long and the TMC-200 extends to 25". The racks are made of heavy-duty chrome-plated steel and are faced with a Kydex™ color bar. No assembly is required, and all mounting hardware is included.

For complete details on the Magna-Grab tool rack, check Reader Service number 263.

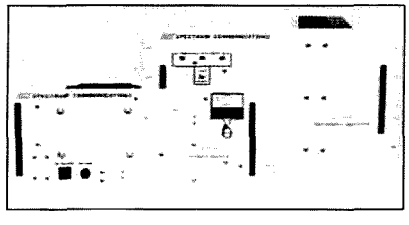


Kepro's bench-to-circuit etcher.

KEPRO PC ETCHER

This holiday season, etch a permanent smile on your favorite electronic hobbyist's face with the convenient, versatile, and economical Kepro Spray Etcher ($765). He'll love you for it. And, with the professional results he'll get on PC boards up to 12" x 12" in just five minutes, you'll love his projects.

For more information on the Spray Etcher and other Kepro products, check Reader Service number 264.



SCA-100 VHF/UHF amps from Spectrum.

SPECTRUM POWER AMPS

The Spectrum SCA-100 150-Watt VHF and 100-Watt UHF amplifiers can be used with any 10–40-Watt transmitter. Their large heat sinks and high-efficiency design ensure cool operation even when run at 100% duty cycle in a hot environment. The amplifiers also feature automatic vswr protection and automatic amplifier bypassing if the power supply fails or the amp overheats. Both amps are designed for 19" rack mounting. A companion power supply, the SCP-30, is also available.

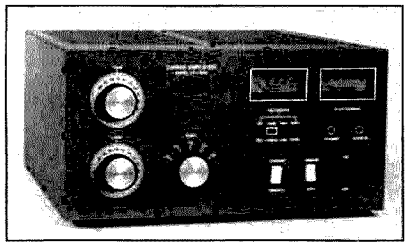
For complete details on these and other Spectrum products, check Reader Service number 265.

SYNTHETIC TEXTILES ANTENNA ROPE

Due to the constant urging of a local ham,

Synthetic Textiles has developed a special double-braided Dacron rope for use in antenna installations. The rope is available in three sizes: 3/32", 3/16", and 5/16". The outer braid is color-sealed black Dacron for resistance to ultraviolet light. The rope unties easily even after years of use and is easily cut with an electric hot-knife (included with every spool).

For additional information, please check Reader Service number 266.



The Barker & Williamson PT-2500A linear amplifier.

BARKER & WILLIAMSON

PT-2500A Linear

The Barker & Williamson PT-2500A linear amplifier is a completely self-contained tabletop unit designed for continuous SSB, CW, RTTY, AM, or ATV operation. A pair of Eimac fast-warmup tubes provide 1,500 Watts output on 1.8–21 MHz (the amp can be modified for use in military or commercial applications). Other features include illuminated swr and power meters, vernier tuning for quick accurate settings, and a silver-plated tank coil for maximum efficiency.

VS-1500A Antenna Coupler

The B&W VS-1500A is designed to match virtually any receiver, transmitter, or transceiver in the 160–10-meter range. The unit will deliver up to 1,500 Watts of rf to almost any antenna, including dipoles, inverted vees, verticals, mobile whips, beams, random wires, and so on, fed by coax, balanced lines, or a single wire.

Other features include a series/parallel capacitor connection for improved harmonic attenuation, an in-circuit wattmeter, and vernier tuning. Front-panel switching allows for rapid selection of antennas or a dummy load.

For details about these and other B&W products, please check Reader Service number 267.

MISSION CONSULTING

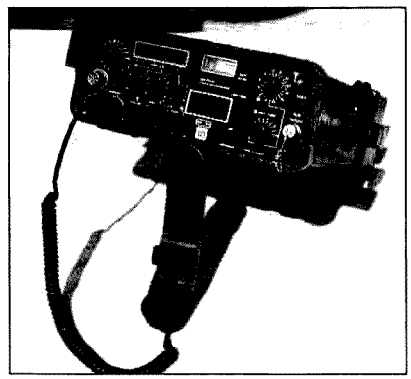
MP-25 Transceiver

Mission Consulting's MP-25 25-Watt SSB synthesized manpack transceiver covers the 2–15-MHz range in 100-Hz steps. This lightweight, immersible radio features a built-in antenna tuner and speaker, and meets MIL-STD-108. Several optional accessories are available for use in fixed operation.

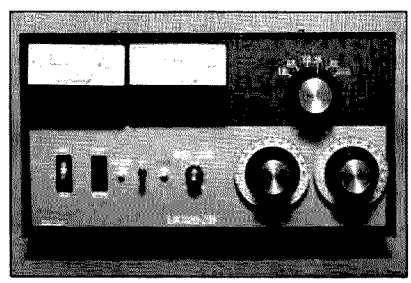
Docking Booster

Boost the range of your HT while operating mobile by increasing its output to 30–50 Watts with Mission Consulting's Docking Booster. The Booster clips onto your car door and includes a microphone clip and an optional GaAsFET preamplifer. The Docking Booster is available for most ICOM, Yaesu, Kenwood, and Santec radios.

For additional details on these products, check Reader Service number 268.



Mission Consulting's MP-25 portable transceiver.



Amp Supply's LK500-ZB linear.

AMP SUPPLY LK500-ZB

This self-contained amplifier delivers 1,500 Watts of rf from 1.8–22 MHz and features a Peter Dahl Hipersil power transformer, an ITT Jennings vacuum antenna-changeover relay, and a companion sealed-relay QSK system. The HF tank coil and Centralab bandswitch are silver-plated. A no-tuneup version of the LK500, the LK500-NTB, is also available.

For further details on Amp Supply linears and accessories, circle Reader Service number 269.

CERTIFIED COMMUNICATIONS

Press Jones N8UG of Certified Communications supplies all of the wire and cable needed by hams. Certified also carries accessories such as insulators, connectors, baluns, ground rods, toroids, and so on. Custom baluns, feedlines, and center insulators can be made to order. Over 3,000 CB-to-10 conversions are in Certified's files.

For more information, please check Reader Service number 270.

RADIO WORKS

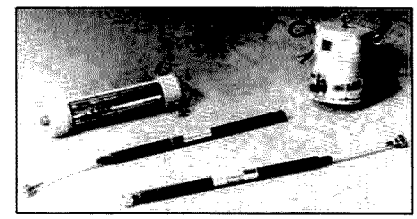
B and C Series Baluns

Radio Works' B and C series baluns, in either 4:1 or 1:1 versions, achieve a balance of wiring inductance, core characteristics, coupling, and construction to produce a well-behaved broadband balun. Prices start at $15.95.

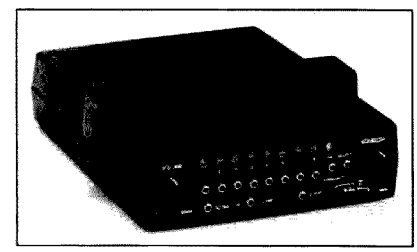
Superloop

The Superloop is a high-performance, automatic-bandswitching loop antenna for 80 and 40 meters. The design uses a decoupling stub in combination with a Dedicated Tuning Unit at the feedpoint for reactance control. The loop is slightly short of a full wave on 80 meters and exhibits gain on 40 meters and higher bands.

A free 32-page catalog is available from Radio Works; check Reader Service number 271.



New baluns from Radio Works.

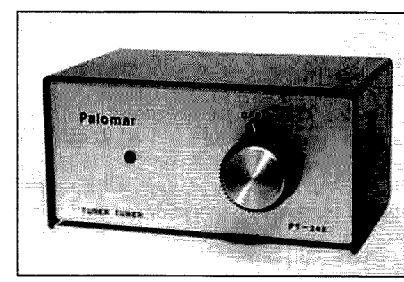


The Regency R806 crystal-controlled scanner.

REGENCY R806 SCANNER

Regency's 8-channel R806 crystal-controlled scanner is ideal for listeners who don't need a fancy synthesized unit. The R806 covers 30–50 MHz, 144–174 MHz, and 440–512 MHz. Other features include a programmable priority control, dual scan speeds, and channel lockout. The scanner is designed for mobile or home use and comes with a mobile mounting bracket, an ac power cord, a dc power cord, and a telescoping antenna.

Get more information on Regency products by checking Reader Service number 272.



The Tuner Tuner from Palomar.

PALOMAR TUNER TUNER

Palomar Engineers have announced their new Tuner Tuner™, which connects between

your transceiver and your antenna matching unit. With the Tuner Tuner you can adjust your AMU without putting a signal on the air. The built-in 50-Ohm noise bridge gives an audible null when the tuner matches the coax line to 1:1 swr.

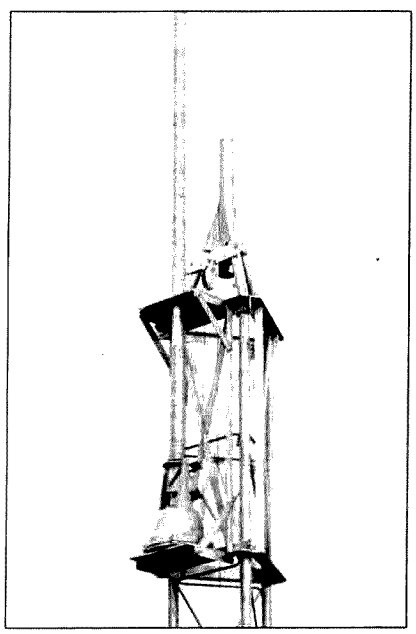
For more information, please check Reader Service number 273.

PAC-COMM DR-100/DR-200

Pac-Comm is manufacturing packet repeater controllers designed expressly for the needs of packet radio networks and remote, unattended operation. The DR-100 provides a basic single-port controller useful for single-frequency digipeaters. The DR-200 is a dual-port controller designed to be an inexpensive, off-the-shelf packet switch for moving traffic on inter-LAN networks.

Both units are designed around the Z-80 CPU with up to 32K bytes of EPROM storage and 32K bytes of RAM. HDLC is handled by a Z-8530 Serial Communications Controller. The DR-200 has two independent 300/1200-baud modems (AMD 7910 World-Chip™), while the DR-100 has only one modem. Both models support an external terminal.

Several versions of single- or dual-port software are available at no cost through Pac-Comm. For more information, check Reader Service number 274.



The Hazer system.

MARTIN ENGINEERING HAZER

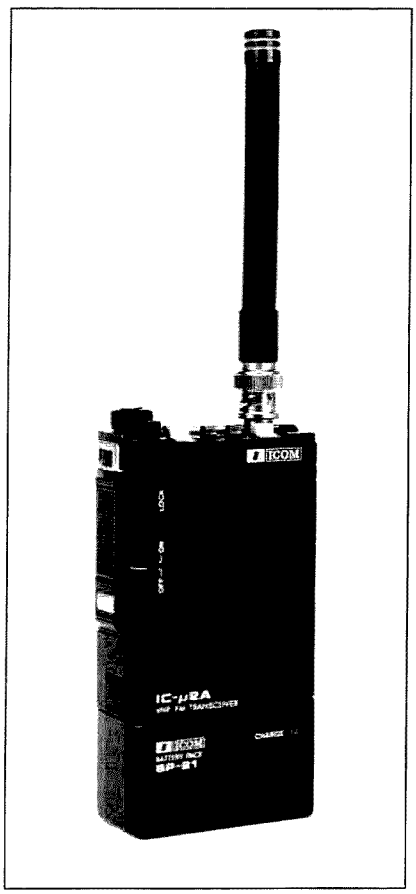
The Martin Hazer is a unique tower accessory that raises and lowers antennas directly up and down the tower. The Hazer is assembled at ground level. An antenna and rotor are fitted to the Hazer, then the entire assembly is winched to the top of the tower. A spring-loaded safety catch engages at every cross brace. At the top, the safety catch transfers the weight of the antenna to the tower.

For more details, check Reader Service number 275.

FOX TANGO ANNIVERSARY

To celebrate his 78th birthday and the 15th anniversary of the founding of Fox Tango, president Milt Lowens N4ML has announced a spectacular sale on his 8-pole FT Crystal Filters for radios from Kenwood, Yaesu, ICOM, Drake, and Collins. Milt bought a bunch of these when the Yen was low, and until the stock runs out he will pass the savings on to you.

For more information on Fox Tango filters, check Reader Service number 276.



ICOM's μ2A 2-meter hand-held.

ICOM MICRO 2AT

ICOM's new IC-μ2AT is a pocket-sized 2m hand-held designed to cover 139–174 MHz on receive and 140–150 MHz on transmit. The Micro features ten memories to store frequency, offset, and access tone; an LCD readout on the top panel; scanning; 1 Watt rf output; and 32 built-in subaudible tones. The HT weighs 1/2 pound and measures 2.3" x 5.6" x 1.1".

For complete details, please circle Reader Service number 277.



New 2400-baud TNC from Kantronics.

KANTRONICS

KPC-2400

The KPC-2400 Packet Communicator combines the KPC-2 300/1200-baud TNC with a 2400-baud PSK modem for high-speed packet operation. An RS-232C/TTL jumper is included to make interfacing to a terminal simple. An add-on modem is available for the TNC-1 and TNC-2 which mounts directly on top of the TNC. It adds 2400-baud packet to your station while maintaining 1200-baud operation. If you own a KPC-1 or KPC-2, Kantronics will take your old unit in trade for a new KPC-2400.

KPC-2

The KPC-2 Packet Communicator features a built-in HF modem, full duplex operation, multiple connects, and over 100 software commands. The unit comes with 128K of EPROM, 16K of RAM (expandable to 32K), and 4K of EEPROM. Any terminal program can be used with the KPC-2; Kantronics offers Pacterm programs for the Commodore VIC-20 and C-64, and the TRS-80 III, 4, and 4P.

For a free catalog of Kantronics equipment, check Reader Service number 278.

PETER DAHL

With a 516F2 Solid-State Conversion kit from the Peter Dahl Company, your power supply will run cooler and gain full protection against line transients. You get solid-state replacements for the 5U4 and 5R4 tubes, a silicon diode to replace the selenium bias rectifier, and a selenium transient suppressor.

For more information on Peter Dahl products, check Reader Service number 279.

HEIL SOUND

SS-2 Magic Box

The Heil SS-2 system contains two 5-Watt amplifiers, a 3.5" air-suspension woofer with an 8-ounce magnet, and a 1.5" hard dome tweeter. Unlike the usual "hi-fi" speaker which has a crossover of about 7 kHz, the Heil SS-2 crossover is at 1.5 kHz, right in the articulate range of an SSB signal. The amplifiers have a 4-dB gain peak in the 1.5–2.5-kHz range to give extra punch to the audio.

Headset Control System

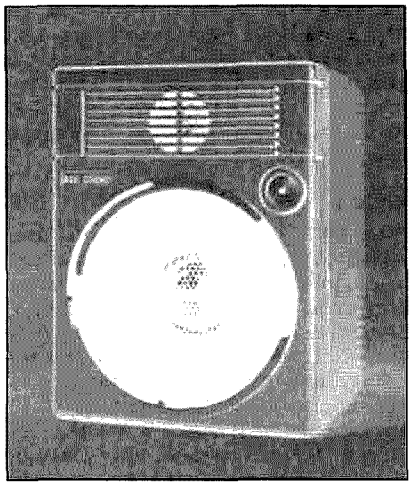
The HCS Headset Control System from Heil is designed for the serious radio operator. The HCS is made up of the BM-10 Boom Headset,

the HCS Interface Amplifier, and the PRS power supply.

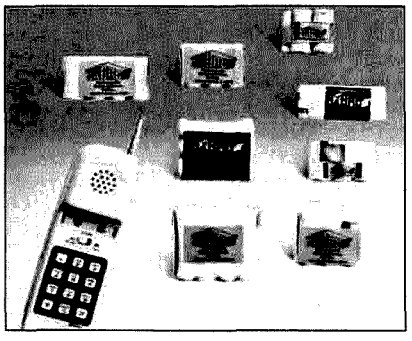
The BM-10 is specially designed for prolonged contesting. Weighing only 8 ounces, the headset can be used with one or two ear pieces and with or without the boom microphone. The microphone is an HC-4 DX Dream Machine and has a 10-dB peak at 2.1 kHz with a sharp rolloff (12 dB per octave) at 600 Hz.

The HCS Interface Amplifier contains a dual-channel 2-Watt audio amplifier with a two-input mixer. When used in stereo mode, one radio can be heard in the left ear and another radio in the right ear. An additional output allows a logger to listen in, and an intercom switch disconnects the radios to allow the operator to talk with the logger.

For more information on Heil Sound equipment, please check Reader Service number 280.



The SS-2 Magic Box from Heil Sound.

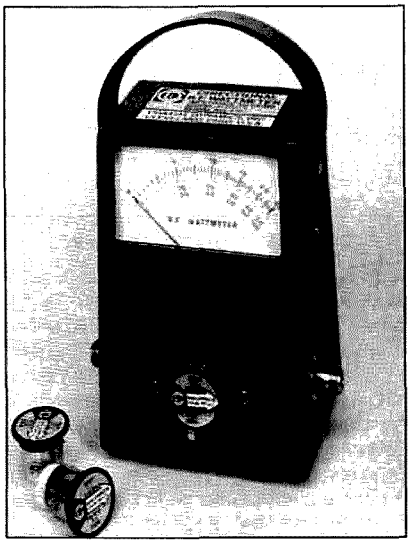


A variety of replacement nickel-cadmium batteries are available in JaBro's new catalog.

JABRO CATALOG

An updated 16-page catalog of replacement nickel-cadmium batteries is now available from JaBro. Additions to their line include replacements for the RCA Tac-Tec 747, Ritron's RT-156, and the Standard BP-11, as well as inserts for Midland models R70-B08 and R70-B12, the Repco 816 and 817, and Motorola's MH-70 and MH-10.

For more information, check Reader Service number 281.

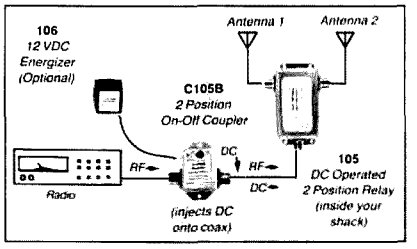


Coaxial Dynamic's model 81000-A rf wattmeter.

COAXIAL DYNAMICS

The model 81000-A Directional Rf Wattmeter is an inexpensive test instrument designed to measure forward or reverse power in coaxial transmission lines. Forty-seven standard and forty-seven special plug-in elements are available, covering power levels from 100 milliwatts to 5,000 Watts and frequencies from 2 MHz to 1,000 MHz. The 81000-A comes with N connectors, but any connector may be specified, including 7/8" silver flange. Maximum vswr is 1.05:1 with N connectors installed.

The 81000-A is one of a series of economical rf test equipment from Coaxial Dynamics; for more information, check Reader Service number 282.



Antennas Etc.'s remote switching system.

ANTENNAS ETC.

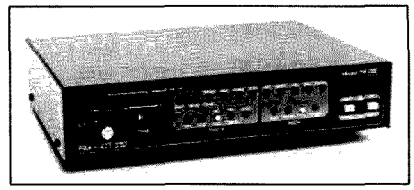
Baluns

Antennas Etc. offers a complete line of W2AU and W2DU baluns for both HF and VHF installations. Models are available to handle up to 9,000 Watts from 1.8–30 MHz and up to 4,000 Watts from 30–300 MHz in 1:1 and 4:1 configurations. W2AU ferrite-core baluns are $17.95, and W2DU non-ferrite baluns are $19.95.

Remote Switching

A remote switching system is available from Antennas Etc. which allows you to feed multiple antennas off of one coaxial feedline. The C105B system will handle up to 1250 Watts from 1.5–180 MHz, and uses a remote dc relay for switching.

For complete details on these products, please check Reader Service number 283.



AEA's PK-232 Pakratt.

AEA PK-232

The new AEA Pakratt model PK-232 is a multimode data controller with the ability to connect any RS-232-compatible computer or terminal directly to a transceiver. The PK-232's internal software handles the decoding, signal processing, and protocol for CW, Baudot, ASCII, AMTOR, and packet operation. Twenty-one front-panel indicators are used to display the operating mode and status.

The PK-232 uses an eight-pole bandpass filter followed by a limiter discriminator with automatic threshold correction. The internal modem automatically selects the correct filter parameters.

For more information on the PK-232 and other AEA communication products, please circle Reader Service number 284.



The Alpha 78 from ETO.

ETO ALPHA 78

The ETO Alpha 78 is a self-contained HF linear power amplifier capable of 2,000 Watts PEP (SSB) or 1,000 Watts constant-carrier continuous operation. It is manually tunable from 1.8–2.0 and 3–22 MHz; four additional bandswitch positions provide no-tuneup operation at the full legal limit on 80–15 meters. The 78 is capable of QSK CW and features full-cabinet forced-air cooling with a ducted exhaust.

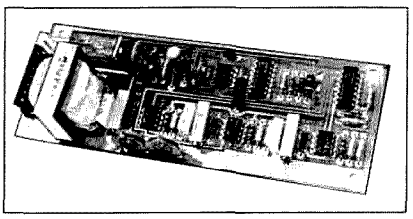
For more information, check Reader Service number 285.

UNTENNA HI-RIZER

The engineers at Untenna have taken a full-sized 40–10-meter vertical and wound it down to a manageable size: 15 inches. Three mounting options are available: a magnetic or clamp mount for use over a large metal surface and a ground screen. The ground screen is a 24" x 30" piece of hardware cloth and only acts as a ground plane on 15 and 10 meters.

20- or 40-meter operation is accomplished by using a 1/2-wave length of coaxial cable (furnished), making a 3/4-wave system on 40 meters and a 5/4-wave system on 20 meters. Tuning is done by tapping the helical radiating element and extending the two capacity-hat whips.

For more details on Untenna products, check Reader Service number 286.

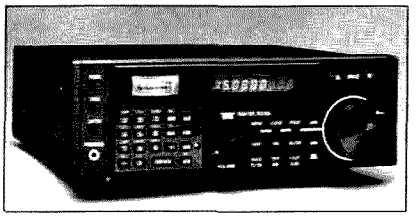


Melco's Hi-Pro BAP.

MELCO BAP

Maggiore Electronic Laboratory (Melco) now offers the Hi-Pro Basic Auto Patch, a single-board controller with all of the functions necessary to implement an auto patch. Features include an adjustable dual-tone two-digit decoder, an adjustable time-out timer, an external disable line, single-supply power, and full-duplex operation. The unit draws only 30 mA at 10–15 V dc.

For more information, please check Reader Service number 287.



Ten-Tec's RX325 general-coverage receiver.

TEN-TEC RX325

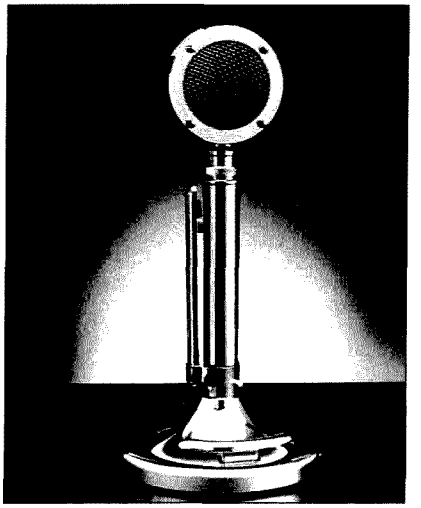
The RX325 is Ten-Tec's newest general-coverage receiver. The rig is fully synthesized from 300 kHz to 30 MHz and features 25 memories, an S-meter with a SINPO scale, a built-in rf preamp, programmable band and memory scanning, and 12 V dc or 120 V ac operation.

For more details, please check Reader Service number 288.

ASTATIC D-104 SILVER EAGLE

Astatic's D-104 Silver Eagle is the result of 50 years of research. It combines a vibrant chrome finish and engraving with a versatile microphone system. The D-104 Silver Eagle will make any rig look as good as it sounds.

For more details on Astatic products, check Reader Service number 289.



The D-104 Silver Eagle.

the HAM STATION

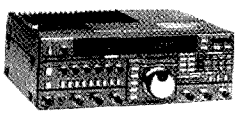
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FT-767
- HF/VHF/UHF Base Station
- Plug-in Modules for 6m, 2m, 440 MHz
- Loaded with Features

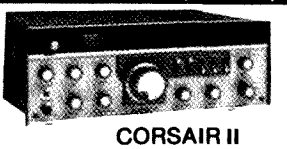
$ SPECIAL PRICE $

FT-727R
- Dual Band Handle
- 5 Watts Power on 2m & 440 MHz
- 10 Memories
- Battery Saver

$ SPECIAL PRICE $

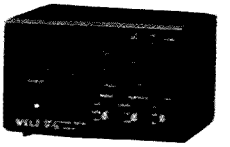


TEN-TEC



CORSAIR II
- You have to hear it to believe it!
- Lowest Noise, Cleanest & Most Selective HF Transceiver Around— AMERICAN MADE

WELZ



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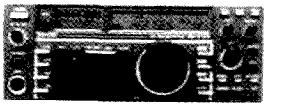
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SPECIAL EVENTS

RICHFIELD MN
NOV 1

The Twin City FM Club will sponsor the second annual Hamfest Minnesota and Computer Expo on November 1, from 7:30 a.m. to 3 p.m., at Richfield High School, 7001 Harriet Avenue South, Richfield, Minnesota. Admission is $3 in advance, $4 at the door. FCC exams given. Talk-in on .16/.76. For more information or advanced registration, send an SASE to Hamfest Minnesota and Computer Expo, Box 555, Minneapolis MN 55440, or to Lyle Vogt KA@UDL, 5130 Willow Lane, Minnetonka MN 55345.

LAWRENCEVILLE GA
NOV 1–2

The Alford Memorial ARC of Stone Mountain will sponsor Ham Radio and Computer Expo '86 on November 1–2, from 9 a.m. to 5 p.m. Saturday and from 9 a.m. to 4 p.m. Sunday, at the Gwinnett County Fairgrounds, 20 minutes northeast of Atlanta. Admission is $4 in advance, $5 at the door. VEC license exams given both days. Talk-in on 146.16/.76 or 449.250/444.250. For more information, contact the Alford Memorial ARC, PO Box 1282, Stone Mountain GA 30086, or call N8LM at (404)-925-7615.

SOUTHFIELD MI
NOV 2

The Oak Park ARC will hold its largest Swap-N-Shop on November 2, from 9 a.m. to 5 p.m., at a new location: the City of Southfield Civic Pavilion, Evergreen Road, between 10 and 11 Mile Roads in the northwest Detroit suburb of Southfield, Michigan. Admission is $4, children under 12 free, VE3s at par. Tables $10. Fire regulations restrict the number of tables. Advanced reservations required. Talk-in on DART 146.04/.64 and 146.52. For further information, send an SASE to OPARC Swap-N-Shop, 303 South Vermont Avenue, Royal Oak MI 48067, or call the Swap-N-Shop hotline: (313)-399-3991.

SELLERSVILLE PA
NOV 2

The RF Hill ARC will conduct its 11th annual hamfest on November 2, beginning at 8 a.m., at the Pennsylvania National Guard Armory, PA Rte. 152, Sellersville, Pennsylvania. Admission is $4 per ham, with accompanying non-ham spouse and children admitted free. Dealer space is $8 per 8-foot by 6-foot space inside and $6 per 8-foot frontage outside. No tables provided. Talk-in on 144.71/145.31, 146.28/146.88, or 146.52. For additional information or to reserve space, call Frank Benner W3BRU at (215)-257-2450, or write Hamfest Chairman, RF Hill ARC, 523 Vine Street, Perkasie PA 18944.

LAS VEGAS NV
NOV 7–8

HAM/WEST and the ARRL Nevada State Convention will be held all day November 7 and 8 at the Hacienda Hotel in Las Vegas, Nevada. Advance registration is $12 before October 24 or $15 at the door. For all info, see the ad on page 11 of this issue or contact HAM/WEST, PO Box 19675, Las Vegas NV 89132; (702)-361-3331.

DALLAS/FORT WORTH TX
NOV 7–9

AMSAT will hold its fourth annual Space Symposium and Annual Meeting at the Dallas/Fort Worth Airport Hilton Hotel on November 7–9. Speakers at the Saturday symposium include experts from around the world who will address the latest in OSCAR news including FO-12, Phase 3C, and the new Phase 4 program. For additional details and registration information, call AMSAT HQ at (301)-589-6062.

NEWMARKET ONT
NOV 8

The York Region ARC will hold the 10th edition of The Newmarket Flea-market on November 8, from 0900 to 1500, at Huron Heights Secondary School in Newmarket, Ontario. General admission is $3, children under 12 are admitted free. Tables are $5 and must be reserved in advance. Contact Geoffrey Smith VE3KCE at 7 Johnson Road, Aurora, Ontario L4G 2A3, Canada; (416)-727-6672 (after 1830). Talk-in on 146.520 and 147.225/147.825. The Radio Society of Ontario will be organizing seminars beginning at 1600 at St. Andrew's College, 300 Yonge Street North, Aurora, Ontario. For information about a banquet following the seminar, contact Evan Herriott VE3IND, 8 Lindal Avenue, Scarborough, Ontario M1L 1W8, Canada; (416)-757-4284 (after 1630).

HOT AIR BALLOONS
NOV 8

The L'Anse Creuse ARC will celebrate the flight of hot air balloons on November 8, from 1200–1500 and 2000–2230 UTC, by operating from hot air balloons on 7.263 ±QRM and 147.420. Alternate weather date will be November 15. For certificate, please send QSL and 9 x 11 SASE to A. C. Koch KA8JJN, 23682 Kim Drive, Mt. Clemens MI 48043.

FORT WAYNE IN
NOV 9

The Allen County Amateur Radio Technical Society will present the 14th annual Fort Wayne Hamfest on November 9, from 8 a.m. to 4 p.m., at the Allen County Memorial Coliseum on Coliseum Boulevard (U.S. 30). General admission is $3.50 in advance, $4 at the door, children 11 and under free. Standard tables $10, premium tables $25. Talk-in on 146.28/.88, 443.8/448.8, and 147.255/.855. VE exams given on Saturday, November 8 with advance registration only. For more information or reservations, contact ACARTS Hamfest, PO Box 10342, Fort Wayne IN 46851. For information only, call Bernie Holm K9JDF, Hamfest Chairman, at (219)-485-0164 between 6 and 10 p.m. EST; no reservations accepted by telephone.

NORTH HAVEN CT
NOV 9

The SCARA annual indoor flea market will be held on November 9, from 9 a.m. to 3 p.m., at the North Haven Park and Recreation Center in North Haven, Connecticut. Admission for buyers is $2. Tables $10 in advance, $15 at the door (if available). For information or table reservations, send an SASE and phone number to SCARA Flea Market, PO Box 81, North Haven CT 06473. Reservations must be received by November 3. For information only, contact Brad al (203)-265-6478 (7–10 p.m.). No reservations will be taken by phone.

"PAPPY" WADE MEMORIAL
NOV 9

In observance of Veterans' week, members of the Hamfesters RC will operate the club's 2nd annual special-event station from the Hines V.A. Hospital's Robert K. "Pappy" Wade K9CDH Memorial Ham Shack, using the Hine's club call K9WFN, on November 9 from 1500–0300 UTC (9 a.m. to 9 p.m. local time). The club will operate on 40m, 20m, 2m FM, and 2m USB. Frequencies to be used are 14.260, 7.260, 146.43, and 144.210. Send QSL, QSO number, and a 9 x 12 SASE to Hamfesters Radio Club, Inc., Chicago, c/o Robert K. "Pappy" Wade Memorial Ham Shack, Bldg. 8, Hines Veterans Administration Hospital, Hines IL 60141.

VETERANS DAY
NOV 9–11

Armored Forces Amateur Radio Net will operate from 1700 UTC November 9 to 2400 UTC November 11, on 10–80 meters, in recognition of Veterans Day. Frequencies: phone—7.283 and 3.920–3.925; CW—7.000. Contact any AFAR member. Send a #10 SASE to WB1DWR AFAR Net, 16 Berkeley Circle, Newington CT 06111.

MILWAUKEE WI
NOV 15

The Milwaukee Repeater Club will sponsor the 2nd annual 6.91 Friendly Fest on November 15, from 8 a.m. to 1 p.m., at The Eagle's Club, 24th and Wisconsin Ave, Milwaukee. Tickets are $3, 4-foot tables are $4. To save $1 per ticket or table, send SASE with payment to The Milwaukee Repeater Club, PO Box 2123, Milwaukee WI 53201, before November 8. Talk-in on 146.91/.31 and 146.52. Exams given at 9 a.m.

ORANGE NJ
NOV 16

The West Orange Repeater Club will hold a hamfest on November 16, from 9 a.m. to 3 p.m., at the Orange Elks, 475 Main Street, Orange, New Jersey. Admission is $3 for buyers, $10 for sellers (per table). Talk-in on 224.80 or 146.550. For further information and ticket reservations, call Mike or Rob at (201)-674-0507 any time.

MASSILLON OH
NOV 16

The Massillon ARC will sponsor Auctionfest 86 on November 16, from 8 a.m. to 5 p.m., at the Massillon K of C Hall, off Rte. 21, in Massillon, Ohio. Admission is $3.50 in advance, $4 at the door. Tables available at $7 per 8-foot space. Talk-in on 147.78/.18. For advance registration and information, contact MARC, PO Box 73, Massillon OH 44646. Include an SASE.

BILLERICA MA
NOV 22

The Honeywell 1200 RC (sponsor of the 147.72/.12 repeater) and the Waltham ARA (sponsor of the 146.04/.64 repeater) will hold their annual amateur radio and electronics auction on November 22, beginning at 10 a.m., at the Honeywell plant, 300 Concord Road, Billerica, Massachusetts, Exit 27 off Rte. 3. Talk-in on both repeaters. For more information, contact Doug Purdy N1BUB, 3 Visco Road, Burlington MA 01803.

GREENSBORO NC
NOV 22–23

The Mark 4 RC will hold its 6th annual Greater Greensboro Hamfest on November 22–23, from 9 a.m. to 5 p.m., at the National Guard Armory, Franklin Blvd., Greensboro, North Carolina. Admission is $4 in advance, $5 at the gate. $9 for 6-foot inside flea-market table. Walk-in exams will be given by AE4N/Mark 4 VEC; call (919)-852-1087. For general information or advance tickets, contact Fred Redmon N4GGD, 3109 Goodall Drive, Greensboro NC 27407; (919)-852-9244 (9–11 p.m.)

OAK PARK MI
NOV 30

The Oak Park High School Electronics Club will hold the 17th annual Swap-N-Shop on November 30 at Oak Park High School, Oak Park MI 48237. Donation is $2. $8 for an 8-foot table.

XMASTIME AWARD
DEC 1–31

The Hen House Gang will be sending out the Christmastime Bethlehem and Santa Award during the month of December. Operation is on 10m, 20m, 40m, and Novice CW. For the Santa envelope and fold-up card, send a first-class stamp only; envelopes will be provided. For more information, write to the club president, Robert J. O'Neil W1FHP, Hard Hill Road, Bethlehem CT 06751.

NEVER SAY DIE

from page 14

So, let me know if you actually need to have a contest to get you to fulfill your civic responsibilities and work some Novices. We can have the Work A Young Novice Event certificate, keeping you up all night over a weekend or two collecting Novice contacts. I think we'll get 'em more involved with amateur radio if you'll actually talk with them—maybe Elmer a little. Let 'em know hamming really is fun.

If you do this and it works—write. If you do it and it bombs for you—write. If you don't do it go soak your head and let me know how that feels. Soaking one's head isn't like it was when I was a kid and there was that rain barrel of icy cold water out by the back door. We saved the rain water to rinse out things—like thunder jugs. Know what they are? Or watering the garden.

What else can we do to help make hamming enough fun for Novices so they'll go for a General? Any ideas? We're working on a series of articles to help 'em understand how radio works—and electronics. With Bash gone, what'll we do—what'll we do?

HAM POVERTY

Not to beat this to death, but the more I read the business magazines, the more I find them echoing my sentiments. *INC* had a particularly interesting article on why blacks have fallen so far behind economically. Both the Asians and the Hispanics have zoomed way ahead of blacks in family income.

The article pointed out that one basic problem has to do with the black perception of success—a cultural problem. They look upon ministers, teachers, and government workers, rather than businessmen, as successes. Thus, instead of starting small businesses, blacks tend to go for low-paying, but to them more prestigious jobs.

Indeed, even when blacks go into business successfully they do not gain prestige in the eyes of other blacks. Blacks in business complain that their fellow blacks refuse to patronize them. You don't see that with Hispanics or Asians. These groups are very protective and supportive of their entrepreneurs.

When I visited Kenya and Uganda twenty years ago, I wondered why there were virtually no black-run small businesses. I talked about this with the local black people and found that blacks wouldn't support black-run stores, preferring to shop at Indian-run stores. Even when the black governments, in desperation, funded black business start-ups, they failed.

In my recollection no other group of American immigrants has done this to themselves. The Irish made sure that Irish-run businesses got their business—as did the Italians when they arrived—and the Jewish.

When you consider that half of the jobs in our country are in small businesses, and about 90% of the more recent new jobs are in this fast-growing sector, it's obvious that entrepreneurs and small business are by far the most important to nurture for the growth of our country.

We've been losing manufacturing jobs to lower-wage countries—and we'll lose more, no matter how the government finagles with protectionism. If it weren't for our keeping out foreign agricultural products and supporting the higher U.S. prices for food, we'd probably lose our farming industry, too. This has led to the ridiculous situation where Senator Dole, in order to protect his state's farmers, has forced the U.S. to pick up a good deal of the tab on wheat sent to Russia—which helps keep down the Russian costs of decimating Afghanistan and escalates our deficit by about $30 billion. Is Dole someone we're seriously considering for president?

So what does all this mean to you, the *73* reader? Well, unless you're already into being an entrepreneur, you're probably having to make tough decisions. As you get to be my age and the doom of retirement hangs over you, you're suddenly very aware of the miniscule dole you're going to get back for all those dollars you thought you were investing in Social Security. The government has been careful not to let it be widely known that this has been primarily a tax, not insurance. So, as Eisenhower put it, they've taken away your dollars and will give you back dollarettes. And not very many of 'em either. Great scam! Certainly you won't get enough so you can comfortably subscribe to *73, QST, CQ,* and *Ham Radio* every year. And not enough so you can join me for a few days on an occasional Caribbean DXpedition—or a fun trip to Asia.

Perhaps you've noticed that once women started working in larger numbers, generating two incomes per family, the prices of houses and cars adjusted to the higher family income—as has almost everything else. It's almost entirely the extra money from two-income families which has made it possible for most small businesses to get started.

You as an amateur have an edge on being an entrepreneur. First, your family income is way above average. Second, you have a better than average education. Third, you have a decided edge in technology, which is where the bulk of the opportunities lie for starting new businesses.

Unless you've wasted your opportunities as a ham to learn about electronics, you're in a great position to start a small spare-time business at home. I'd like to hear from readers who've done this so other *73* readers can get ideas. I know there's an almost infinite need for technicians able to repair computers. And that's sure easy to get into. First you buy your own computer. It will break (that's a guarantee). After you've sweated out your own you'll find friends begging you for help. Jump at it and learn all you can. Start passing the word—then perhaps your business card to local businesses. The next thing you know your kitchen, garage, and cellar will be piled with computers waiting for you to fix and your phone will be ringing day and night as frantic businessmen plead to get 'em back so they can keep their businesses going.

I've mentioned the enormous opportunities in security installations for homes and businesses. A new home business is developing in desktop publishing, where a $10,000 investment puts you into business.

If you're short on imagination you should be reading magazines such as *Success, INC, Business Week, Forbes,* and so on. They're filled with ideas. I also get ideas from reading the science magazines such as *Discover, Omni, Popular Science,* and so on. If I could find the support people to make things happen, I could get a hot new business started at least once a week. Sadly, finding people with the ability and enthusiasm to take an idea and make it work is extremely difficult.

Oh, I try. I recently mentioned a chap I hired who had every opportunity and blew it by building a large staff and endlessly planning, but no sales. Now he's mad at me because he was finally—after wasting several hundred thousand dollars—fired. Another chap was given one potential small business after another to start up—blew 'em all. Nice chap, but unable to either follow directions or replace them with intelligent decisions.

Continued on page 98

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SCARA ANNUAL INDOOR FLEA MARKET. Date—Sunday, November 9, 1986. Time—Sellers, 7 a.m.; Buyers, 9 a.m. to 3 p.m. Place—North Haven Park and Recreation Center, North Haven, Connecticut. Price—Tables, $10 in advance (first come, first served); $15 at the door (if available); Buyers, $2. For information or table reservations, send SASE and phone number to: SCARA Flea Market, PO Box 81, North Haven CT 06473. Reservations must be received by Nov. 3, 1986. For information ONLY, from 7 p.m. to 10 p.m., contact Brad at (203)-265-6478. NO RESERVATIONS WILL BE TAKEN BY PHONE. BNB481

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RECEIVERS

The first three months of this column, of which this is number two, have one feature in common—there has not yet been time for reader input as to what subjects you would like to see discussed! When reader input gets thin, or nonexistent in the case of the first three columns, I will fall back to the "safe" strategy of discussing something of general interest.

For this month, the subject will be receivers. I might have started with antenna systems, but in the case of the VHF frequencies where most people are going to get started, antennas are fairly noncritical, at least for starters. The *Weather Satellite Handbook* describes several options for VHF satellite antennas, and even small two-meter antennas (3–5 elements) can be pressed into service to snag your first pictures. What you cannot fudge on is the receiver. Unless it meets certain minimum requirements, you may hear the satellite with a strong and consistent signal but you will *not* be able to get a decent picture.

To understand this seeming paradox, it is necessary to understand some aspects of the rf formats employed in weather satellite transmissions of potential interest to amateurs. All of the weather satellite transmissions you are likely to be interested in are transmitted in an FM format. When you choose a suitable FM receiver, the three primary criteria are sensitivity (noise figure), frequency coverage, and bandwidth.

Sensitivity/Noise Figure

Sensitivity is not a problem, despite the fact that we want the lowest practical noise figure, since an outstanding preamplifier can be added to any receiver that meets our other requirements. Modern GaAsFET preamplifiers for two meters (144–148 MHz) are available off the shelf with noise figures below 1 dB. Many of these are available in weatherproof housings for mounting at the antenna (a very good idea to eliminate the problem of transmission line losses). Virtually all of these can be retuned to cover the 137–138-MHz VHF satellite band, and many manufacturers will retune them for you when you place an order.

We will look at some available units in future columns, but the bottom line is that if you have a receiver that is suitable in other respects, noise figure/sensitivity can be brought up to any needed requirements very easily. Of course standard MOSFET and JFET preamps can be used as well. I would avoid bipolar preamps, as these have a tendency to overload, particularly in areas with a lot of rf crud.

Frequency Coverage

The frequency range of interest is fairly narrow, with all polar orbit transmissions confined to the 137–138-MHz range. U.S. TIROS/NOAA polar orbit transmissions are made on frequencies of 137.50 and 137.62 MHz. Each of the two operational spacecraft that are ideally in service at any one time will use one of these frequencies. NOAA-6, for example, uses 137.50, while NOAA-9 uses 137.62. Each has backup capability on the alternate frequency should a primary transmitter failure occur. Soviet METEOR/COSMOS weather satellite transmissions occur on a wider variety of frequencies.

In the past, 137.15 and 137.30 MHz were the two "prime" frequencies, and there still appears to be an operational METEOR spacecraft—and often more than one—on 137.30 MHz most of the time. In recent years 137.85 MHz has been used quite regularly, although other "oddball" frequencies in this range are active on an occasional basis. Whether this is by design or due to transmitter control problems is uncertain. In any case, your receiver must cover 137.50 and 137.62; 137.30 and 137.85 are desirable options.

Reception of geostationary WEFAX transmissions on 1691 and 1694.5 MHz (the latter used only by the European METEOSAT) is usually accomplished by using a converter ahead of the basic VHF FM satellite receiver. LO injection for the converter is adjusted so that the desired signal comes out at one of the "standard" VHF satellite frequencies (usually 137.50 MHz).

Bandwidth

Bandwidth turns out to be one of the biggest hurdles to overcome since all of the various satellites use deviation values that are significantly higher than those employed for standard FM voice links. The biggest market for FM receivers, if we leave out FM broadcast and TV sound, is for various kinds of scanners operating in the police and public-service bands. These transmissions typically deviate a maximum of ±7.5 kHz and the receivers are usually set up for 15-kHz bandwidth.

Unfortunately, if you tally up the values for signal deviation for a spacecraft such as the TIROS/NOAA series (±18 kHz) and Doppler shift (±3 kHz), you end up with a required bandwidth in excess of 40 kHz! A signal from one of the polar orbiters, received on a typical scanner with 15-kHz bandwidth, will be severely distorted and will not produce a usable signal. A straight carrier will sound fine, but a modulated signal is a mess. Although deviation levels are lower for the Soviet METEOR polar orbiters and the geostationary GOES and METEOSAT spacecraft, their signals are still too wide for satisfactory reception with a stock 15-kHz-bandwidth receiver. You would face exactly the same problem if you put a converter on an old two-meter receiver!

Receiver bandwidth is typically set by one or more filters in the i-f chain. There is almost always a crystal or ceramic filter at the 10.7-MHz first i-f and there is often another, usually ceramic, at the 455-kHz second i-f. If the receiver employs a crystal or ceramic filter at 10.7 MHz, it can often be widened by simply adding an inexpensive 30-kHz crystal filter in place of the original. A cheap 30-kHz filter will have very wide skirts and you will end up with a receiver with sufficient bandwidth to do the job. In contrast, a good 30-kHz filter will have steep skirts and the receiver will still be too sharp for TIROS/NOAA service.

The *WSH* provides some advice on crystal filter selection. If the receiver also uses a 455-kHz ceramic filter, you may have a problem since wider ceramic filters at this i-f frequency are harder to come by. I have had good success in some instances by simply replacing the 455-kHz filter with a small coupling capacitor.

Date	01 November 1986	
Spacecraft	NOAA-6	NOAA-9
Orbit Number	38192	9714
Eq. Crossing Time (UTC)	0105.71	0106.21
Longitude Asc. Node (Deg. W.)	99.23	152.74
Nodal Period (Min.)	101.127	102.0638
Frequency (MHz)	137.50	137.62

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 1. TIROS/NOAA orbital predict data.

Receiver Selection

In selecting a receiver, either off the shelf or for modification, the bandwidth factor should be foremost in your mind. In the sections that follow, I will outline some general strategies for receiver selection and modification. You should consult the *WSH* for more detailed coverage, including the addresses of the various vendors that will be noted.

Commercial Satellite Receivers

Obviously, the simplest approach is to buy a receiver designed for satellite reception. Models are available from vendors such as METSAT Products and Vanguard Labs. The most inexpensive options are crystal-controlled, and the crystal investment is quite modest since you will rarely want more than about four frequencies, unless you want to search for experimental Soviet spacecraft.

Kits

Your most economical option is to build a receiver from a kit. The number of VHF FM receiver kits available is now quite limited, but

fortunately Hamtronics still has several models, one of which is specifically broadbanded for satellite use. Such receivers are typically crystal-controlled.

Converter/Communications Receiver

Another possibility, not often considered, is to use a converter ahead of a communications receiver equipped with an optional FM i-f. If the FM option will provide sufficient bandwidth or can be modified, this approach can be very effective. The receiver will be tunable, but the high accuracy of most HF receiver vfo's will not present a problem in monitoring a specific frequency. You could modify a standard two-meter converter working into a 10-meter i-f (add a new LO crystal and retune), or you could contact companies like Spectrum International and have them modify a converter for you. Again, double-check the FM bandwidth specs; if the receiver is too narrow, you will get a strong but unusable signal!

Scanners

Now we come to the subject of scanner receivers! These beasts come in three general configurations: first-generation crystal-controlled units, programmable units covering the public-service bands, and wide-coverage programmable units.

Before I discuss each category, a few general guidelines are in order. First, if you are going to buy a new unit, insist on seeing a schematic. In the case of the Radio Shack receivers, such a schematic is usually in the manual, although you may need a magnifying glass to read it. The purpose of this step is to look at where the filters are located in the circuit. If you buy a used scanner, see if you can get a Sams Photofact sheet on it from your local electronics distributor.

Try to stick with units that employ standard i-f frequencies (10.7 MHz and 455 kHz), as you will have more luck in locating replacement filters to widen the bandwidth. I personally would avoid receivers that use other i-f frequencies. Ideally, try to get the dealer to open the case for you. Most will not, but try anyway. This will give you a chance to assess the mechanical aspects of filter replacement.

Crystal-controlled scanners are by far the simplest to work with. Generally the board layouts are more open, making it easier to get at the filters, and the VHF HI band (144–174 MHz) can usually be retuned to cover 137 MHz. Do not expect spectacular sensitivity since the front ends are designed for broadbanded service. But don't worry about it either since an external preamp will be needed in any case.

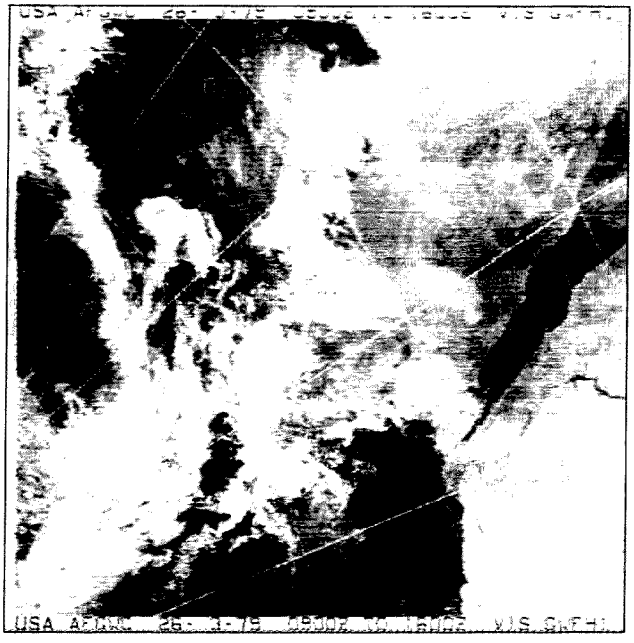


Photo A. Computer-formatted image of the Red Sea area, which was retransmitted through the GOES E spacecraft at 1691 MHz.

Programmable scanners designed strictly for public-service use present two problems. The first involves the tuning range. Most scanners are strictly limited to 144–174 MHz in the VHF HI range, and entering a 137-MHz satellite frequency will get you an error message of some sort. Two solutions are possible—setting the receiver on a frequency that provides high side injection for a satellite frequency and retuning the rf stages to peak at 137 MHz, or the use of a converter to convert the 137–138-MHz satellite band to a frequency range in the VHF LO band (usually 30–50 MHz).

The second problem, which concerns bandwidth, is preferred, but both options are described in the *WSH*. The PC boards of these receivers tend to be quite tight in layout, and actually getting at and replacing filters can be a problem. The degree of miniaturization makes it imperative to locate equally small replacement filters, and this can present difficulties. Here is where examining the circuit and looking into the unit can pay dividends prior to purchase!

The most impressive scanners of all are the wide-coverage units that represent the new generation of scanning receivers. A unit like the Regency MX5000, for example, will tune directly from 25 to 550 MHz in 5-kHz steps, features programming of AM, narrowband FM, and wideband FM for any channel, and has 20 memory channels with all sorts of fancy search options. A receiver of this sort looks ideal since there are no tuning problems and the wideband FM mode, designed for TV sound and FM broadcast use, is certainly wide enough for the satellite signal. Unfortunately, the wideband mode is *very* wide, resulting in a severe degradation of the signal-to-noise ratio (S/N).

A GaAsFET preamp at the VHF antenna will usually minimize noise and maximize signal to the point where a receiver of this sort is useful for polar orbit service, but geostationary WEFAX use presents a problem. Even a GaAsFET preamp for 1691 is significantly noisier than a unit for 137 MHz, and the only solution for boosting the signal without introducing more receiver noise is higher antenna gain.

You will have relatively poor results in trying to use a small (1.2-meter/4-foot) dish with such a receiver even though it delivers a satisfactory signal when used with a 30–40-kHz-bandwidth receiver. The system will work if you use a GaAsFET preamp and a larger (3-meter/10-foot) antenna such as a TVRO dish. But all of this adds to the expense of your system, not to mention the required antenna space. All such problems would disappear if the narrowband FM filters could be replaced with 30–40-kHz units, but the circuit board of a receiver like the MX5000 is packed to the limit with the smallest components you will see outside of an IC. I have no intention of attempting surgery on mine and I am usually quite casual about such modifications!

Receiver Modifications

Regardless of what approach you take to the station receiver, a few additional mods will be useful. The first concerns power supplies. A *very* well-regulated 12-V supply should be used. Scanner ac supplies almost always have an unacceptable hum level. You may not notice it on voice, but it *will* show up on pictures.

A second desirable modification is to provide a constant peak-amplitude audio tap from the receiver to your display system and tape recorder. This makes the video drive level independent of the receiver audio gain control and is quite handy. The easiest way to accomplish this is simply to tap off the top of the volume control (point furthest from ground) using a 0.1-uF disc or mylar capacitor, and then bring the line out to a phono jack at the rear of the receiver.

Trying It Out

Preliminary checks on the receiver can be made with a vertical quarter-wave antenna (51 cm/20 inches) connected directly to the antenna jack. With such a setup, you should be able to hear both TIROS/NOAA and Soviet METEOR spacecraft clearly during the best parts of a good pass. There will probably be considerable fading and noise, but you *will* hear the birds. For operational service, I would recommend the "Satellite Zapper" described in the *WSH*, preferably with a Vanguard Labs JFET preamp at the antenna or, better still, one of the newer GaAsFET units.

For the optimum in low-budget service, you can always clip a battery-operated receiver to your belt and hook up a 3–5 element two-meter beam. You can then stand in the backyard or on the roof and manually track the bird while piping the audio back to the station for recording. This approach is crude but extremely effective. You probably won't need a pre-

amp, given the fact that you have only a very short line to the antenna (a meter or so), and you can move the small antenna easily, rotating it to optimize polarization while monitoring the speaker or using a set of headphones. The neighbors will get a kick out of it, but it does work!

Picture of the Month

This little gem dates back to March, 1979. A failure of one of the early TIROS/NOAA satellites left NESS depending upon an Air Force weather satellite for polar orbit coverage. This particular image was computer-formatted and retransmitted through the GOES E spacecraft at 1691 MHz. To get the correct geographic perspective (N to the top), you should rotate the picture 90° to the right, although I will describe it as printed. The picture covers the eastern end of the Mediterranean. The Red Sea is very prominent on the right side, and the Nile River and Lake Nassar (behind the Aswan High Dam) are visible below it. One end of the Caspian Sea is visible at the top of the picture. The picture was printed on the facsimile recorder described in the *WSH*.

Next Month

Next month I will discuss some basic audio processing of the satellite signal from the receiver. This will be useful no matter what kind of display you will be using.

The *WSH* refers to the Third Edition of the *Weather Satellite Handbook*, available directly from the author for $12.50 postpaid in the United States and Canada and $14 elsewhere in the world. ■

FUN!

Number 17 on your Feedback card

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TVI TROUBLE

Ol' Benjamin Franklin has always been a sort of hero of mine. When Ben wasn't over in Paris teaching the local female nobility how to French kiss, he was back home in Philadelphia devising witticisms. One of Dr. Franklin's all-time best sayings is "Nothing is certain in life but death and taxes," or something like that.

Ben obviously wasn't a ham, for if he were an advocate of the wireless arts, he would have known that television interference (TVI) is also one of life's certainties. Ben was born before TV was invented, so I guess we can forgive him for the omission.

Over the years I suppose I've generated just about every sort of interference that can be inflicted on a boob tube. I take pride in running a clean station, but when you live in New York City and have dozens of television antennas within a cat's whisker of your tribander, TVI is just impossible to avoid. I've gone through dozens of low-pass filters, and have given away enough high-pass filters to propel one major manufacturer of such devices onto the Fortune 500.

One year, I even pulled a Santa Claus routine. I dressed up like St. Nick, got a big brown sack, and handed out high-pass filters to the neighbors as if they were peppermint canes.

"Ho, ho, ho, little boy. MERRRRY CHRISTMAS. Here's a high-pass filter."

"Gee! Thanks, Santa. But I was hoping for an HW-101."

"Ho, ho, ho. Get lost, you little punk."

When the neighbors continued to complain about the interference I was causing, I thought I would wait until spring and dress up like the Easter Bunny. That way, I could carry additional filters from a beautifully decorated Easter basket. I thought better of the idea, however, figuring that two filters wouldn't be much more effective than one. Anyway, I don't look good in a bunny suit.

When I think about TVI, two stories immediately come to mind. The first is about the time I got a QSL card from a TV DXer in Dallas who said I was S9 +40 on channel 2 during a six-meter band opening. The more interesting story, however, concerns one of my first run-ins with an irate neighbor.

My TVI problems go back to the days before I was even a ham. In 1968 I was a CBer. In the golden days before CB hookers, 18-wheeled good buddies, and pinheads with affected southern drawls, the Citizens Band could be a lot of fun, even in a big city like New York. The bands were fairly empty, the chatter tended to be a lot more interesting than most ham QSOs, the equipment was cheap, and you didn't have to pass a code test. I was 14 and CB was a better way to BS with friends than to hang around the local candy store.

So, most evenings would find me in contact with my CB buddies, Morgan (Phantom), Jon (Willow), and Smitty, a mature 17-year-old who didn't need a CB handle and was sure his hypertension would let him beat the draft.

I was just telling Jon why I felt the "new" Nixon would beat the "old" Humphrey when my mother knocked. She opened my bedroom door a crack and said, "The neighbors are complaining again. Mr. Madden says you're coming in on his TV. Tone it down."

Since "tone it down" was my mother's euphemism for "shut off the rig" and since the conversation was just getting interesting (Jon was an HHH man, Morgan favored Wallace, and Smitty was an anarchist), I became furious. As it was, I had de-peaked my rig to about 100 milliwatts and was occasionally wiped out by a pizza delivery service located in a neighboring county.

"Tell Mr. Madden I'm coming over to talk to him, Mom," I shouted through the door. Jon, who had experienced TVI problems of his own, volunteered to come over to give moral support.

"The two of us will be a TVI committee, just like they're always writing about in *QST*," said Jon.

This wasn't my first encounter with Mr. Madden. He was a tough customer whom I had faced before. What made talking to Mr. Madden all the more difficult was the fact that he was stinking drunk all of the time. I mean, really stinking drunk. You could smell the guy a mile away. You could ignite his breath, and his general body odor wasn't the most pleasant either.

There was another thing about Mr. Madden: He was red. Not just a red-neck (although it was) or a redhead (although he did have red hair). I mean the guy's skin color was red. Beet red. The sort of red that made you think his eyeballs were going to pop out at any minute and spatter you with blood. Weird. Drunk and weird and red.

Still, he was a neighbor, and the FCC and ARRL both agreed that you should treat your neighbors courteously. Only I never remembered seeing anyone like Mr. Madden in any ARRL training film.

So, about a half an hour later, Jon and I knocked on Mr. Madden's door.

"Whooz dere?" said a wobbly voice from the other side.

"John Edwards," I replied. "You complained that I was interfering with your television."

The door opened a little, closed a little, and opened a little further. Mr. Madden was having trouble mastering the intricacies of portal operation.

"Ohhhh yezzzz. You. You'vvvv been coming over acrozzz my teeveee," he managed to get out. Like a true drunk, it was taking some time for his brain to comprehend and act upon the situation. Eventually, however, he realized that I was the foe who was interfering with the broadcasts of "The Flintstones" and he got angry, very angry.

"Nowww youuu loook here," he stammered. "I've taken jussst about all I'm goin' to, youu creep. Either you turn off that radio or I'mmm going to pop you."

Yipe! Fisticuffs! Being a devout coward, I pushed Jon in front of me.

"Say something, Jon," I said.

Jon, who had an uncanny knack of sizing up a situation instantly, said, "Sir, you are drunk."

Mr. Madden didn't say a word, he just hauled back and tried to push Jon's nose against his tonsils. Fortunately, since Mr. Madden was indeed drunk, he missed and splattered his knuckles into the door jamb.

Jon and I ran. We weren't going to wait for Mr. Madden to take a second swing.

Later that evening my father paid a visit to Mr. Madden. I don't remember if he took a shield, a suit of armor, or any hand grenades along. My father, however, was a British soldier during World War II and knew how to take care of himself.

"Son," said my father, "can that radio of yours transmit pictures?"

"No," I replied. "It doesn't make a very good helicopter, either. Why the stupid question?"

"Well, you see, when Mr. Madden claimed that you were com-

ing in on his TV, he really meant coming in—picture and all. In fact, he said he's seen you on 'The Carol Burnett Show' and 'Gomer Pyle.' "

What do you say to something like that? My father knew what to say. "I told him to complain to the FCC," my father reported. Good old fatherly common sense.

I don't know if Mr. Madden ever got around to writing his letter. The FCC never contacted me, and shortly after this unfortunate episode, Madden, his wife, and the two little Maddenettes moved out in the middle of the night. We never heard from them again, thank heavens.

Which just leads me to think, were my nightly TV appearances merely the result of an alcohol-ridden brain or were they a new, hitherto unreported type of TVI? Or, as Jon suggested, perhaps it had something to do with alien beings, UFOs, and the Bermuda Triangle.

Oh, well. I've always liked Rod Serling nearly as much as Ben Franklin. And, for some reason, my rig never interfered with the "Twilight Zone."■

QRP

Number 24 on your Feedback card

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RULES OF TEN

"Hams never build anymore!" That seems to be the battle cry. Well, if it were not for the AMers, packet people, and us QRP types, it might be ham radio's swan song. That's not to say others don't build; it's just that these groups seem to be soldering up something all the time.

At the Dayton Hamvention, people stand in line just to buy parts. I just don't believe that all those parts will end up as plastic paperweights. So equipment building still has a very strong foothold in ham radio. But Dayton happens only once a year. How do you get all the small parts needed for your next project? Well, there are always more hamfests, but no guarantee that what you'll need will be available. So, what to do? Without a doubt, mail-ordering parts is the way of building in the 1980s. It's a buyer's market, but also, buyers beware! I have a system that I call "Mike's Rules of Ten."

Sometime around 1975, there was a ham radio store that was doing some very bad mail-order business. One magazine took it upon itself to call attention to the problem. That magazine was *73*. There was a warning to new Novices seeking new equipment and, of course, to the parts buyers. What was the company? Trigger Electronics. Even with all the news about the dealings with Trigger, a lot of money was lost due to fraud. Yes, even I got bit, but using my Rules of Ten sure saved my money supply.

OK, just what are these rules of ten? Quite simply, this. When dealing for small parts with a new supplier, order only whatever is the minimum-order amount. This normally is about 10 bucks. When ordering small parts, like transistors, diodes, and the like, order in units of ten. This will save you money—sometimes as much as 30 cents on each part. Then wait ten days (working days) for the order. Using this method, I lost only 10 dollars to Trigger. Yes, I, too, sent copies of my cancelled check to the infamous "Miss Dolly," and several phone calls later was still without my order. So I lost 10 bucks, but it could have been much worse.

Now that my Rules of Ten are common knowledge, what is the best mail-order house and what's the worst? Well, I'm going to stick my neck out on this one. I have made up a list of some of the people I have done business with. Since these are only my opinions, don't send hate mail to *73* but to me. Perhaps someone may have some bad tales to tell about one of the vendors that I like. Also, if you have had good service from a parts vendor, send me the company name and ordering requirements. I would like to expand the list. Meanwhile, here is what I have now, with each vendor rated on a one-to-ten scale, with ten being the best, of course. Again, these are only my opinions.

First on my list is All Electronics Corp. While they have several walk-in stores, all mail orders should go to PO Box 20406, Los Angeles CA 90006. They have a 10-dollar minimum for orders and will take plastic money but no CODs. They sell surplus goodies, new small parts, wire, switches, etc. They have a fine catalog that's free; send for it. They also have very fast service, so they get a 7 on my scale.

Back in 1974, a vendor started to show up in this magazine. Its ad style is still copied today. At that time it was called "James Electronics." Today we know them as Jameco (1355 Shoreway Road, Belmont CA 94002). Primarily selling IC chips and computer parts and accessories, they have become THE source for components. While the minimum order is now 20 dollars, they do accept plastic money. A new catalog costs a buck. A top-rate vendor, they get a 10.

What Jameco is to ICs, Circuit Specialist Co. is to small rf parts. A free catalog may be had by writing to PO Box 3047, Scottsdale AZ 85257. Here is a QRP builder's dream come true. Aside from the usual offerings of transistors and IC chips, Circuit Specialist also offers a vast supply of rf chokes, chassis, PC-mount air-variable capacitors, and meters, just to name a few items. But perhaps the best news, there is no minimum order amount when a check or money order accompanies the order. Yes, they do take plastic money but then there is a 15-dollar minimum. A super vendor, they get a 10.

I can't think where you might be located without one of these stores nearby—Radio Shack. They are one of the very few places left where you can walk in and get some parts. The only trouble is that they may have discontinued the part or simply are out of it. Their prices may be a bit out of line, but on a late Saturday night when you really need that one part to finish up your project, you'll pay the price. Get to know the people who work at your local Shack. They will sometimes alert you to possible advance sales on the parts. Given all of this, the old "Shack" gets a 5.

JDR Microdevices, 1224 S. Bascom Avenue, San Jose CA 95128, is a clone of Jameco. Not connected in any way, their ads look very similar. Computer parts, integrated circuits for the hobbyist, and those hard-to-find computer chips comprise the bulk of JDR's business. A 10-dollar minimum order is needed. Plastic money is also fine to use. They don't have a catalog proper, but advertise monthly in magazines. A very fine vendor, fast service, and friendly people, they rate a 9.

Mouser Electronics, 11433 Woodside Avenue, Santee CA 92071, reminds me of the old Allied Electronics. Their catalog looks very much the same, only smaller. They sell everything from soup to nuts. It's very unlikely that you can't find what you want in the catalog, which is free. While I think the prices are not the best, the quality is. On that remark, they get an 8.

There is one place many of us don't even bother to look: the old junk box. The photo shows a 40-meter transceiver I built from two sources—Radio Shack and the junk box. It sports vfo frequency control and has an output of about 12 Watts. (If enough interest is expressed, I will print up the plans.)

Looks like I'm about to run out of space. In my next column I'll look at some more parts vendors and discuss how to buy parts and keep a good stock of the most needed QRP goodies.■



A QRP transceiver built with Radio Shack parts and a well-stocked junk box.

NK6K > PACKET

Number 22 on your Feedback card

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Most of my previous packet columns have had some sort of theme, or at least they've been limited to one or two topics. This month, I'll dig into the bit bucket and pull out some short subjects, mostly in response to mail received here at NK6K.

First, the nocturnal habits of the West Coast *packeteerrius rattus*. I'm a late-to-bed, late-to-rise type. I roll out of bed around 9 a.m. and sack out around 2 a.m., after "Late Night with David Letterman." I also work at home. Therefore, people who call me on the phone at 6:30 a.m. West Coast time hoping to "get me before I go to work" usually don't get a coherent answer to whatever question they might have had. Note also that there is a three-hour difference between Redondo Beach and the East Coast, not two.

Since I don't have a "company phone" to use, all returned phone calls cost real money. I return far more than I should, but I'm trying to cut down. To get the fastest, most coherent response to a question, send it to NK6K-2 via the packet-forwarding system. Unless I'm out of town, this usually gets a same-day response. People not yet on packet are welcome to use paper mail, but that's too easy to stack up and hide away, so a fast answer via paper is unusual. An SASE is always appreciated.

Portable Packet

Chip McCoy WB9OZX wrote in to ask about the portable packet system pictured on page 30 of the August issue. His question is "What additional software is required to use the TRS-80 Model 100 as a packet terminal?" The answer is "none." The Model 100 has a built-in terminal program called TELCOM. Most of the other lap-top computers have a similar program. For the Model 100, start the TELCOM program and enter the following command: STAT 57I1E. Then say TERM. This should start you talking to the DB-25 serial port at 1200 baud.

Apple BBS

Jon WA2YVL asked about the N6BGW-9 BBS pictured in the August issue. He's looking for a W@RLI-forwarding compatible system that will run on the Apple. Scott Avent N6BGW is running a system that was originally developed by Lynn Taylor WB6UUT. Scott has since added a W@RLI-forwarding receive mode and is working on a forwarding transmit mode. Other than this system, I am unaware of any other W@RLI-compatible system for the Apple. If you have one, please write in and let me know. WA2YVL will be moving to South Freeport, Maine, soon, so look for his BBS up there.

France

Remy Jentges F6ABJ sent in a short report on packet in France. He's been involved in promoting the AX.25 standard and in getting about 250 TNCs up and running. He's also working on getting a WA7MBL system up on VHF. They will have had a packet general assembly meeting in October; packet is showing good growth in France.

Flip-Flop

Earl Morris N8ERO writes to say that he has added another bell and whistle to the add-on connect beepers available from several sources. He's added a flip-flop to the connect light so that the LED stays lit after a connection has finished. This lets him know if anyone has connected, left a message, and disconnected while he was out of the room. He's also added a switch to pull the DTR line on the TNC serial port to ground when he's not around. This forces the TNC to hold on to any data received. Some users have had trouble in the past when they simply turn off their terminal, since the DTR line might float and not inhibit characters from "falling on the floor."

N8ERO also notes that a TNC can be connected directly to a modem, giving packet users access to the phone network, and phone users access to packet. This is an interesting experiment and has some useful applications, but care should be taken when connecting amateur frequencies to a non-amateur medium. If the possibility exists that an unlicensed individual can gain access to an amateur transmitter, a non-automated control operator must be present. If you have implemented procedures, such as passwords, that ensure that the phone caller is licensed and is therefore able to operate your station as a control operator remotely via the phone line, you're in the clear. If you aren't sure of your security, it's best to disable that feature if you are not present and able to act as a control operator.

Note that once traffic that originated from a non-amateur has passed through that first non-automated control operator, it may be automatically repeated through the amateur digital network. This is discussed elsewhere in this column under the topic "Third-Party Traffic."

Newsletters

There are perhaps more packet radio newsletters in the land now than any other "specialty" group, and most other specialty newsletters and magazines include a packet column. This is because packet is still new and growing. If you've been on packet for a week you should have come to know more than 20 other new packeteers in your line of sight. Your local packet club and its newsletter can tell you more about how packet works in your area than a national magazine like this one can, so be sure to support your local group to get both parts of the story.

I'll continue to give you the big picture here. Several packet groups exchange newsletters; this is an excellent idea. I get a copy of several, and they're all very good. The only problem is a lack of steady input, which usually burns out the editor after a few months. I want to thank the crews at NAPRA's *Zero Retries*, the Packeteers of Long Island's *Poli Parrot*, and NEPRA's *PacketEar* for keeping me on the list.

Third-Party Traffic

I still get several queries a month on the topic of third-party traffic: "What is third party in relation to packet?" The most recent inquiry came from KM@M.

The best way to start the discussion is to look at the rule-making action in PR Docket 85-105. Also known as the automatic control docket, it gives complete and unambiguous permission to hams to run automated, unattended digital stations: when transmitting digital communications on frequencies above 50 MHz and while NOT sending third-party traffic.

As the result of several petitions for reconsideration and a petition for Extraordinary Relief filed by the ARRL, the FCC partially (and temporarily) waived the third-party provisions of PR 85-105. That waiver said in part:

"(a) The provisions of Section 97.80(b) and 97.114(b)(4) are waived to permit amateur stations, retransmitting digital packet radio communications (see Section 97.69) on frequencies 50 MHz and above, using the AX.25 (or compatible) protocol, to be operated under automatic control while retransmitting third-party traffic. See Section 97.3(v).

"(b) This waiver applies only to the retransmission of third-party traffic originated at another amateur station which is under local control or remote control. See Section 97.3(m)."

AX.25 is specified by name because it is the protocol in use by 99% or more of all U.S. hams and is therefore the most universally monitorable, and because each frame has a complete ASCII callsign identifying the sender. The FCC wanted to make sure that, during the period of the waiver, hams could continue to:

"...ensure that amateur facilities and frequencies are not used by non-amateurs. Only a person who has demonstrated the proper qualifications may be a control operator of an amateur station. Such control operators screen any third-party traffic to prevent transmissions which are prohibited by Subpart E of the Amateur Rules.... Those prohibitions include, but are not limited to, business communications, secret messages, radiocommunications for unlawful purposes, and radiocommunication with nations which have not assented to third-party traffic."

What does all this mean? Ignoring international traffic for the moment, my interpretation is that third-party traffic may be sent by an amateur station under digital control above 50 MHz as long as the traffic was originated at a station with a live non-automated control operator. Obviously, any BBS messages to be automatically forwarded or packets to be automatically digipeated that are originated by a ham are permitted. Any messages to be automatically forwarded or packets to be automatically digipeated that started from non-hams are permitted as long as a ham is present at the station at which the messages are put into the network. That means that a Red Cross worker can type mes-

sages into the keyboard of a packet terminal for transmission on the packet network as long as a ham is there to screen the messages. You may not turn your station over to that worker while you hike down to the food tent. You may, however, turn a computer over to a non-ham, who can then store messages on a disk while you are gone. When you return, you can screen the stored messages, and then dump them into a TNC.

The PR 85-105 docket, with waiver, is also clear about what you may not do. You may not:

- Run an unattended station below 50 MHz, no matter what the circumstances. It must have a control operator.
- Use the various digital rules and waivers above or below 50 MHz to send third-party traffic to foreign countries that do not permit such communications.

To summarize yet again and still ignoring international aspects:

1) Anything can be sent on packet above 50 MHz, automated or not, as long as a ham starts it into the network, either directly or as a control operator, and if that ham ensures compliance with all other Part 97 rules regarding permitted and prohibited communications, primarily no secrets and no business.

2) You can't run a digital HF station unattended, no matter what kind of traffic you're sending. Sorry, but those are the rules.

Note that whether or not the messages are third party have been factored out of the above, so we can ignore the question of what is third-party traffic. As long as a live ham is present at the starting point, the rest of the stations in the network can forward the message without reviewing it. The FCC asks that, for the period of the waiver, we carefully monitor packet transmissions and report any abuse of an automated station to the control operator so he can take proper corrective action.

Now for the hard part, international packet. If you don't leave messages for anyone outside of North America or to areas where we haven't signed a third-party agreement, you may skip to the end of this section. Otherwise, we must define third party. Looking at Part 97.3(v), we see:

"Third-party traffic. Amateur radio communications by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of anyone other than the control operator."

Let's look at an unambiguous case first: If NK6K is talking on 20 meters to G3YJO in England, that's legal. If an unlicensed friend of mine, standing in the room, wants to say "hello," that would be third party and not permitted. The friend's hello is not on my behalf, and therefore is not legal.

Now let's look at a tougher case. NK6K is talking to G3YJO through a satellite. At first glance, there are three parties involved, the control operator of NK6K, the control operator of G3YJO, and the control operator of the satellite. Fortunately, 97.417(c) exempts satellites from having control operators. In practice, amateur satellites are usually treated (when counting parties) as lumpy parts of the ionosphere. Therefore, the fact that you have relayed a message through a satellite does not make it "third party." A store-and-forward satellite would be treated in the same way.

Actual third-party traffic—e.g., if a friend wanted to say hello through my radio over the satellite—would still be illegal, unless a specific third-party agreement had been signed between the two countries involved.

We can define an even tougher case. Can a licensed ham send a message on VHF through several unattended digipeaters to a gateway, have it relayed via other VHF gateways to a satellite gateway, have it uplinked to a store-and-forward satellite, and then downlinked to a ham in a country that we don't have a third-party agreement with? Yes. The fact that it is going through a satellite can be ignored, since that does not turn traffic into third-party traffic. Going through automated digital stations does not make it third party. Thus ignoring the relay points, the question is then, is the communication on behalf of anyone other than the originating amateur station and the destination amateur station? In this example, it isn't, so it's OK.

There is one last case that is firmly in the middle of a gray area. What if, in the above example, one of the intermediate relay paths between the originator and the satellite gateway is on HF. Here we can't invoke the PR 85-105 waiver, since it doesn't apply below HF. All I can say is that since the message started with, and on behalf of, a licensed amateur, and it will end up with a licensed amateur, and the intermediate points are simply an automated extension of the ionosphere, it ought to be OK. It is certainly not OK if the communication is not on the behalf of the control operators at the end points when the countries at the end points haven't signed a third-party agreement. As long as we keep that in mind, we're OK.

Bunk

I've been hearing a lot of talk lately that Wayne doesn't realize the value of packet radio. Well, that's a lot of hooey. On Friday at the September ARRL National Convention in San Diego, the August "all packet" issue of *73* was selling as a back issue for $1. By Saturday, the August issue was selling as a current issue for $3. That should show those rumor mongers. I also understand that Wayne (or a reasonable cardboard facsimile thereof) spent the night enthroned in the DRONK hospitality suite, but I'm still waiting for photo proof on that one.

Kids

I'm short of space here, as always, but I wanted to mention something that happened last weekend at the ARRL National Convention in San Diego. A Youth Forum was held, chaired by astronaut Dr. Tony England W0ORE. I was one of the panelists. There were about 150 kids aged 9–15 in the audience. During my pitch, I asked the kids how many of them had a computer at home. Every hand went up. Later in the forum, a mother asked what it would cost to get involved in amateur radio. I then asked how many kids had a disk drive on their computer. Most of the hands went up. I pointed out that the cost of the cheapest TNC and a swap meet, special 2-meter radio is less than the cost of that disk drive. Not all potential young hams fall into this category, but a great many do.

Keep this in mind when pitching amateur radio to the younger crowd. Get a computer into the demo somewhere; it will be a good point of reference for them. Beware, though, one of the little rug rats is likely to tell you something you didn't know about your own computer.

Next month (maybe), the first ever *73* packet poll. See you then.■

UTILI-CASTING?



While some mergers result in funny names, the recent merger of **Monitoring Times** and **International Radio** (formerly the **Shortwave Guide**) has resulted in an excellent new 60-page magazine covering full-spectrum utilities communications as well as worldwide shortwave broadcasting activities. To keep it simple, we've retained the name of one of the two partner companies—**Monitoring Times**. It's all new, bigger, more colorful and more informative. Clearly, it's the most comprehensive publication for the radio listener available today! ✓71



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RTTY LOOP

Number 26 on your Feedback card

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

CoCo BONANZA

I am a bit confused this month because the honorable editor of *73* pulled an editorial string and shifted some dates around. However, if I read things right, this should be published in November, so a Happy Thanksgiving to you all.

In the last column, I promised some goodies for the rather vocal CoCo crowd, and I shall not let you down. By now, I assume most of you have heard about the CoCo 3. Just being announced as this column is being written, the Tandy Color Computer 3 promises to present a serious challenge to many of the newer computers on the market.

A look at some of the listed features should be enough to boggle the mind. How about 640 x 192 pixel graphics in four colors, or 340 x 192 pixel graphics in 16 colors from a palette of 64; or RAM expandable from a supplied 128K up to 512K; or a built-in 80-character by 24-line display; or television (rf), composite video, and RGB monitor outputs; or even the ability to run OS-9 Level II? And all this for less than $240, according to my current sources! It sounds like quite a deal, and I for one can't wait to get my hands on one!

For those of us with current CoCos, however, the battle cry has been "give me a good RTTY program" for longer than I can remember. Well, folks, listen to this.

Ken E. Crowston VE5BBP, in Shellbrook, Saskatchewan, is the North American distributor for Grosvenor Software. This British line offers programs to put the Color Computer onto CW, RTTY, and AMTOR, and all for a rather modest price. Let me tell you a bit about the programs first.

The Morse program, BMKCW, functions as a full-service CW transceiver, kind of a glass Teletype™ for CW. The speed range, applicable to both sending and receiving, is from you've-got-to-be-kidding slow to about 200 wpm. Transmit speed is set up at the start and stays constant independent of received speed. Receive speed tracking is automatic and can be set to respond to machine or hand-sent code. A sidetone is even available to listen to through the television speaker to aid in tuning or monitoring. Want more? More than 20K of received data is stored and can be reviewed. Push-to-talk is directly controlled from the keyboard. A transmit type-ahead buffer is maintained, with editing of characters possible before transmission. And, not to forget, the ability to save and retrieve pages of text to and from disk.

No great surprise, the RTTY program, BMKRTTY, looks and feels very similar to its sibling program. This is, however, a very well put together program. RTTY may be received through an external terminal unit or with the computer directly doing the decoding of received audio. The computer is programmed to handle standard 170-Hz, 425-Hz, and 850-Hz shifts, without the need for an external demodulator. Murray baud rates of 45 (amateur standard 60 wpm), as well as 50, 75, and 100 are supported. ASCII data exchange is also supported at 110, 300, and 1200 baud. Some systems may even handle 2400 baud, they tell me.

The rest of the features are enough to make your head spin! A split-screen, type-ahead buffer supports some 4,000 characters in the transmit buffer. About 19K of data, close to an hour's worth of transmission, can be stored and saved to disk. Unshift on space, or not; automatic CR/LF at the end of a line, with programmable line length; even a receive "standby" mode, which monitors for a valid RTTY signal—kind of like autostart—are all provided. Oh, and let's not forget built-in RY tests, and QUICK BROWN FOX keys, as well as a 31-character scratchpad memory to enter the other guy's name and call into.

Both the CW and RTTY programs include identification keys, by the way, which transmit your call on CW, RTTY, or both on command. Your call comes pre-programmed when you buy the program, and can be changed only by the dealer upon a nominal payment with suitable documentation. This is a novel method of copy protection, in that you are free to make as many copies as you like, for your own use, but give one to a friend, and he is stuck with your ID!

The third member of this set is BMKAMTOR, an AMTOR transceive program for the Color Computer. By now, the features of this program should be fairly familiar. Split screen, user memories, disk save and recall, transmitter control, and other RTTY-like features are available. While this program does require a bit more hardware, including a 1-kHz external clock, the benefits to be gained are also a bit more. A 24-hour clock is displayed on the screen and is transmittable. Several modes of AMTOR transmission are supported, including FEC, ARQ, and listen to ARQ. And yes, CW identification is built in as well.

Now, as to the bottom line, I do hope you are sitting down for this. In Canadian dollars, the CW program sells for $28, the RTTY program for $28, and the AMTOR program for $45. Remember, these are Canadian dollars, so a conversion will be required to U.S. dollars, and the prices do not include postage and handling. So why not drop Ken a line, at Crowston Enterprises, 307-111 Wedge Road, Saskatoon, Saskatchewan S7L 6S8, Canada, and ask for a catalog and price list. RTTY software has been scarce, so let Ken hear from you, and tell him that you read about it here in RTTY Loop!

Galfo Update

One of the things that never ceases to amaze me is the ability of you readers to come forth with information to help others. In what may be a continuing saga of Apple communications, the tale of the Galfo program goes on. Jim Marold WB2TZK/7J1ABK/KA2JM/NNN0IFL writes with his story of Apple programs. He says:

"The Galfo program is actually called HAM.M communications disk. In addition to the RTTY/CW program capability, it has several other programs included. The main point is it runs in Integer Basic. The old Apple][ran Integer Basic as a matter of course, but the II+ requires Integer Basic be loaded into the language (16K expansion card in slot 0). If that's not available, there is an Applesoft program that emulates Integer Basic. Run that prior to running an Integer Basic program; as long as there is enough room in memory for both programs, you're up and running. The program was written by Dr. C. H. Galfo. There may also be a SSTV program on the disk.

"The program is certainly user friendly. On booting, it informs you of how much space is allocated to the receive and transmit buffers. This space can be shifted to put more in receive if desired. It then asks whether you want Morse, Baudot, or ASCII. If Baudot is selected, it then asks at what baud rate. The next question is word or character transmission, then the fill character (blank, LTRS, none). The program then goes into the receive mode with 2/3 of the screen for receive and 1/3 for transmit. There is a single status line with a tuning star. Calling various control keys allows putting either buffer on disk or getting a file from disk, changing speeds, changing modes, etc.

"The program handles machine CW very well compared to [another program I have used]. I monitor 10.415 MHz for Ursigrams (solar activity reports), which is machine-keyed at 20 wpm by JJD/JJD2 in Tokyo. The HAM.M program prints the CW as it's sent, and the wpm can vary without taking hits. If it drifts too far off, a simple Control-R puts it back on the chosen speed. The [other] program doesn't recognize the spaces in CW and runs everything together. When your data is five character number groups, reading [the other program's output] can get tedious. HAM.M looks at the game I/O port for a specific configuration. You must modify the software or your TU to match. [The other program] allows you to configure the software as part of the start-up procedure. Since I use a homemade TU, I had more problems getting [the other program] to look at the right pins than HAM.M."

I appreciate the information, Jim, and I am sure that the Apple users who frequent this corner of *73* second the thoughts.

Audience Participation

Have you noticed the "new look" of *73*? For those of you who may have just arrived, the changes are under the auspices of Wayne Green W2NSD/1, who founded this magazine and serves as a driving force behind the vanguard of amateur radio. Among all the things the new *73* gives you, it asks for only one thing in return. In each issue of *73* is a Feedback card. Tear it out, fill it out, and send it in. All it will cost you is a stamp. Tell Wayne what

you think of the various articles and columns (RTTY Loop is "Great," right?), add your comments, and send it in. The staff assures me that the cards are read and that their content does make a difference. And, you stand to win a year's worth of *73* if your card is pulled from the hat! Go ahead, do it now; I'll wait right here.

Are you back? Thanks. Now, remember that if you want to ask me a question, you can drop me a line at the address at the top of this column or send me E-mail on either CompuServe, using ppn 75036,2501, or Delphi, using username MARCWA3AJR. If you want a copy of the list of reprints or a personal answer in the mail, be sure to include a self-addressed, stamped envelope for Postal Service inquiries.

I have a stack of mail here to go through for next month. They tell me that contesting is the theme. Somehow that seems appropriate—because every month I have a contest, going through the mail you've sent me, attention RTTY Loop!■

ATV

Number 15 on your Feedback card

Mike Stone WBØQCD
PO Box H
Lowden IA 52255

ATV continues to fascinate many amateurs who have not yet experienced the thrill of being able to send their own video pictures. I've always been fascinated to be able to work ZS6BTD, ZS6AO, I3XQW, VO1BL, 8P6NC, ZL1BLV, HR2HH, FM7CD, ZL2FR, LU4EGO, OT6DI, OZ4IP, 5NØDOG, OH5RM, G3WW, and VP9IH on phone as well as SSTV. The nearby DX crowd around the 14.230-MHz SSTV operating frequency always manages to disrespectfully QRM SSTVers because they don't realize that SSTVers have the right to operate those shrilling tones anywhere in the phone bands. SSTVers purposely huddle together around one little area, though, for companionship and so as not to QRM others. It irritates DXers, I think, to have the SSTV crowd work rare ones right along with them on 15 and 20. On UHF FSTV hundreds of local amateurs are spellbound at ATV demos when they see the quality of full-color FSTV being sent on 420-440 MHz.

ATV seems to be the mode that is last on everyone's list of things to try out—but it is the most fun to operate. Why's that? I don't know. What could be simpler than a small UHF antenna, some coax, a tiny black box (downconverter), and a hookup to a TV set that probably is already in your shack. But if you just mention "TV" or "video," it scares the heck out of the people who think they have to be broadcast engineers to understand and operate the mode. Heck, I'm the editor/publisher of *The Spec-Com Journal* and I don't understand just how the video picture works. I know about lines and pixels and something called sync, but that's about it. Don't let the fact that you know nothing about ATV stop you from getting some gear and getting on. The mode needs your participation, and the work you put into it will be worth it because you'll gain a whole new bunch of friends.

Canada			
Alberta	Abe Mackay VE6AMU	New Hampshire	M. R. Natola WA1EZE
British Columbia	Allan Tucker VE4ADQ	Rhode Island	Open
Manitoba	Open	Vermont	E. J. Nowas N1QG
Maritime-Nfld.	Lewis Roberts VO1BL	Western Massachusetts	Mel Dunbrack W1BHD
Ontario	Lloyd Morgan	**Northwestern**	
Quebec	D'Arcy Brownrigg	Alaska	Frederick E. Wirth, Jr. KL7FAP
Saskatchewan	Open	Idaho	Albert Hale N7AL
Atlantic		Montana	Carter S. Emert KA7CJZ
Delaware	Elmer R. Boyer W3YAH	Oregon	Open
Eastern Pennsylvania	John Shaffer W3SST	Washington	Robert Fielding W7BGP
Maryland-DC	Bruce Brown WA9VGK/4	**Pacific**	
Southern New Jersey	Open	East Bay	Open
Western New York	Ralph Janowsky W2RPO	Nevada	Open
Western Pennsylvania	Richard Davies K3SPI	Pacific	Stephen S. Barnes KH6SB
Central		Sacramento Valley	F. A. Burgess W6IEV
Illinois	Henry Ruh KB9FO	San Francisco	Gerard Wilson WA6RDA
Indiana	Don Miller W9NTP	San Joaquin Valley	Open
Wisconsin	Dean Andrewjecski AD9W	Santa Clara Valley	Clay Abrams K6AEP
Dakota		Roanoke	
Minnesota	Ronald P. Hines WA9NJR	North Carolina	Herman Perkins W4TVQ
North Dakota	Pius Klein W8HJU	South Carolina	Hap Griffin, Jr. WA4UMU
South Dakota	Open	Virginia	Bruce Brown WA9GVK/4
Delta		West Virginia	Open
Arkansas	John J. Okopinski W5RET	**Rocky Mountain**	
Louisiana	Phillip Spencer W5LDH	Colorado	Terry W. Thero WBØOMN
Mississippi	James P. Allen W5LWS	New Mexico	Open
Tennessee	Ed Draughn WA4KMG	Utah	Douglas R. Cook WB7SOW
Great Lakes		Wyoming	George Schueller WAØGIL
Kentucky	Clyde Miller WB4AOH	**Southeastern**	
Michigan	Allan L. Smith WB8YOB	Alabama	Douglas Hall KD4EM
Ohio	Dave Morris WB8PJZ	Georgia	David A. Carter WA4VHP
Hudson		Northern Florida	Robert Sutter W3SOB
Eastern New York	Dean Morelli N2DDL	Southern Florida	Bob Calvert N4IVB
NYC-Long Island	Open	West Indies	Miguel O. Navarro KP4DGW
Northern New Jersey	Ken Barber W2DTC	**Southwestern**	
Midwest		Arizona	Bill Munsil N7AOU
Iowa	Mike Stone WBØQCD	Los Angeles	John Ruckert WB6ZPN
Kansas	Carl E. Schafer W8EFZ	Orange County	M. H. Klos KA6GVY
Missouri	Dave Williams WBØZJP	San Diego	Jack Dobbs WB6AXW
Nebraska	John Gebuhr WBØCMC	Santa Barbara	David B. Johnson NF6F
New England		**West Gulf**	
Connecticut	Ronald W. Sizer K1VYU	Northern Texas	Open
Eastern Massachusetts	Richard B. Kendall W1JFK	Oklahoma	Mike Veldman WDØCTA
Maine	Phil Whitehouse W1GEE	Southern Texas	Andy MacAllister WA5ZIB

Table 1. U.S. ATV Society state section manager volunteers. Please include an SASE when corresponding with these managers. Apply to WBØQCD for open positions.

FSTV Groups

One of the big problems in becoming active on FSTV is trying to find out where the nearby UHF operators are sending their pictures, what frequency they might be using on two meters, and what antenna polarization is being used. A lot of that work has been done for you. In 1983 the United States ATV Society was formed. The body was organized into 73 volunteer section manager positions. Although some positions are vacant, most states are well represented. Table 1 lists the USATVS managers. Feel free to contact your area's representative to help you get going on ATV (include an SASE if you write). If you're already active on FSTV, please update these volunteers as to the activity in your area.

Where Are They?

Metrovision (Washington DC area), formerly WR4AAG and now WA9GVK/R, has video out on 426.25. The local two-meter auxiliary audio frequency is 145.070 FM. Metrovision has over 40 ATV operators registered with the USATVS. In *Michigan*, WB8YOB has reported lots of activity. The Arrow repeater near Detroit is on temporary authority by the FCC to operate FSTV until the land-mobile business-band service gets going, but they are working on a 900-MHz system. KB8NR is active in the Flint area and is one of the original old-timers. W3SST reports good activity in the *York, Pennsylvania*, area not too far from the *BRATS* (Baltimore) ATV group. *St. Louis* ATV is alive and

well with WB0ZJP leading a group of ten or so UHFers. They monitor 144.430 FM locally. In the *Davenport, Iowa*, quad-cities area, about 30 FSTVers are on the air DXing simplex and working the fancy horizontally polarized 100-Watt N9CAI ATV/R. Most of the Midwest, including the *Chicago* area, uses 144.340 for a two-meter "talk" channel. The *Minneapolis/St. Paul* ATV group is led by WA9NJR on 147.57 and is full of activity. *California* uses 434.0, with 146.43 for two-meter audio; there are also several repeaters. Write to W6ORG for more information. There is a big ATV group in the *Phoenix* area called the "AAA5 Club" that is led by N7AOU. In the *Calgary, Alberta*, area, about ten ATVers are active (VE6AMU); there are about thirty near *Toronto*.



Photo A. 200-mile FSTV DX received by WB0ZJP in St. Louis.

Polarization

Antenna polarization is a nagging problem in some areas. Horizontal polarization is used for FSTV across most of the nation. This allows ATVers to also operate 432 SSB on the same antennas. Vertical polarization is used in California, Florida, Virginia, parts of Indiana (around Indianapolis), and parts of Texas. This allows 440–450 FM to be operated.

There are 60 plus ATV repeaters known to be operating in the country at last count (1982) and they are a mixed bag of polarization. It doesn't really matter which polarization mode is used in your area as long as you find out what the standard is and go with the crowd. Polarization has become quite a controversial subject among ATVers who like to DX. A number of horizontally polarized, omnidirectional antenna designs have been published, with a 7-dB K4NHN rib-caged modified Alford Slot having been successfully demonstrated this year at Dayton by the Cayce/Sumter/Columbia, South Carolina, ATV group.

Surveys show that the English-made Jaybeams and KLM beams are the most popular ATV antennas, followed by K2RIW's antennas and home-brew yagis. Good low-loss coax is very important on UHF frequencies, yet it is always the least-attended-to detail. A good rule of thumb is not to settle for anything less than Belden 8214 or Saxon 8285. Even with a 4.5-dB loss per 100 feet at 400 MHz, you will still lose nearly *half* of your power output and incoming receive on any long runs. The new Belden 9913 is now the hot buy for ATVers, with losses as low as hardline. Beware of 75-Ohm cable TV hardline. I know it is usually free, but you get what you pay for.

Preamps help amplify the received signal quite a bit. Some models can be switched out of line during transmit even at very high power levels. Advanced Receiver Research (Box 1242, Burlington CT 06013; (203)-582-9409) can provide you with some interesting brochures on preamplifiers if you ask for them. For more specific details on UHF antennas and coaxial cable, consult *Everything You Always Wanted To Know About ATV *but were afraid to ask* ($9.95, Spec-Com Publications, PO Box H, Lowden IA 52255).

SSTV Equipment

A few years ago, getting into SSTV meant spending nearly $1,000 to get the latest B/W scan converter, an audio cassette recorder, and a camera. Today you have a choice. You can still put out a lot of money and purchase the latest high-tech color SSTV equipment—Robot Research 1200C, $1,295, 256 pixels across the screen by 240 lines; high-resolution color makes for a beautiful 8-, 12-, 24-, 36-, or 72-second image picture; the unit does all sorts of tricks including automatic tracking and split-screening. (For a four-page color brochure on the system, send an SASE to Robot Research, Inc., 7591 Convoy Court, San Diego CA 92111.) Or you can look around for some older/used equipment, computer software, or interfaces.

Let's think cheap for a minute (not a big mental leap for most of us). Manufacturer-discontinued Robot 400 SSTV scan converters used to cost $795 new. They can still be found "new" at $395 on some dealers' shelves. Used converters can be found at most hamfests for as little as $150 if you barter a bit. These units are B/W, have a good picture resolution of 128 pixels per line by 128 lines, and will store one full picture in memory. (They can be converted to color with 400C board updates.) You simply hook a closed-circuit- (CCTV) or VCR-type camera to the FSTV input and it will convert the "live" picture into a slow-scan one. A simple connection to the audio input of your HF rig's microphone connector is all that is necessary for transmit interfacing. One audio wire runs from your speaker to the back of the Robot 400 for incoming signals.

Transmission picture rate is the former standard of 8 seconds per frame. Contrary to popular belief, there is still a lot of 8-second SSTV being sent. All modern day SSTVers have 8-second compatibility. All you have to do is explain the type of gear you are running and they will switch over to the faster speed format for you. During the Saturday SSTV nets, net controls try to always send an 8-second formatted picture for those still running that type of gear. There have been dozens of modifications to the Robot 400, and Ralph Wilson WB0ESF has compiled most of them into a thick booklet called *Robot Mods*. It is available for $11 ppd. from WB0ESF at 4011 Clearview Drive, Cedar Falls IA 50613.

If a Robot 400 is still a bit rich for your budget, then look for the older Robot 70 or SBE SSTV Converter gear. This equipment utilizes P7 image burn tubes of green or yellow and must be viewed in a dark corner to be seen correctly. Good pictures can be received and sent on this type of equipment, and the cost is usually under $100 for the whole outfit. Still too rich? How about a "reduced resolution" computer software program to receive and/or send SSTV. Radio Shack Color Computer owners have been watching SSTV pictures for years on a completely interfaceless (other than one audio wire from the receiver) 16K software program called "SLOWSCAN" from Kinney Software. This program has been modified to include just about all the current speed formats being used in SSTV, and it even receives and displays "false coloring." Dick Kinney W8MBD (121 Hampton Road, Donnellsville OH 45319) astounded the Dayton crowd this year with computerized SSTV for the Commodore 64. Unlike the CoCo program, which is receive only, SLOWSCAN III (C-64) receives and transmits by use of an owner-constructed interface card. Dick also has a video digitizer circuit and software that complements the program and construction kit. The C-64 software/kit packages sell for $39.95 each. There is also SSTV computer software for IBMs and Apples.

Clay Abrams K6AEP wrote a ton of software and interface designs for the CoCo for a number of years, but he gave it up when a small band of pirates tried to make some quick cash by selling his work. Clay moved on to the IBM computer, and he has once again developed some high-resolution SSTV and FAX software that will knock your socks off. Write Clay at 1758 Comstock Lane, San Diego CA 95129. Ralph Taggart WB8DQT even came out with a single-chip circuit called a ROM-SCANNER, which stores and sends SSTV pictures. If you missed out on the *Voyager* and space shuttle SSTV pictures from space a couple of years ago, Wayne Harrell WD4LYN (Route 1, Box 185, Sycamore GA 31790) now maintains a unique video and SSTV audio tape program collection and he will make quality duplications for a moderate price. Write him for a catalog.

You see, you can spend $39.95, a couple of hundred dollars, or up to $1,295 to get going on SSTV. The important thing is to get in there and get your feet wet with something.■

ABOVE AND BEYOND

Number 14 on your Feedback card

Peter Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

POLARIZATION

Actually, this all started out innocently enough . . . I was going to mow the lawn . . . really! It's just that every time I go outside to work, I always take a look up the tower and begin to think of new antenna arrays.



Photo A. The horizontal vs. vertical polarization test range. The 5/8-wave vertical is in the foreground and the KLM beam is in the background. Crescent, VHF/UHF's most famous dog, guards the test setup.

An incident that occurred earlier this summer came to mind: I had helped my uncle Ray Putman N2FYC install a new 17-element F9FT yagi at his home in Alexandria Bay, New York. After the job was completed, my wife and I proceeded to our summer home on Wolfe Island, Ontario, about 20 miles upriver near Kingston.

Ray and I initiated successful contacts on 146.550-MHz FM simplex; he was using his beam mounted horizontally on a 10-foot tower, while I employed an old reliable KLM 4-element yagi strapped to one of the roof studs with shock cords—also horizontally polarized. He used a Kenwood TR-7400A, while I was barefoot with an ICOM IC-2AT.

During the course of our first QSO, Ray asked what, if any, difference in signal strength would occur if he changed his antenna to a vertically polarized installation. I was in a position to do just that and within seconds unlashed the shock cords and rotated the KLM 90 degrees. Ray reported a drop of three "units" on the Kenwood scale! If the meter was accurate, these would be 3 S-units, worth about 6 dB apiece.

Of course, even not knowing what those "units" meant (if anything), it was pretty obvious to Ray that my signal had undergone substantial deterioration. And this brings me to why I didn't get the lawn mowed the other day . . .

One of the more common complaints I hear from newcomers to 2-meter SSB who previously operated 2m FM is that "there's no activity" or "I can't hear anyone" or even "all the signals are so weak. How do you make a reliable contact on SSB or CW?"

The problem becomes pretty obvious. In every case, the operators are still using the same old Cushcraft Ringo Ranger or Hustler vertical or KLM J-pole or even a vertically polarized yagi that was being used for FM work! It's not Murphy, but polarization losses that are doing them in—the same principles that allow satellites to transmit two different signals on the same channel by making sure they are polarized 90 degrees apart.

How much difference is there between signals received in the same plane as the receiving antenna and in opposite planes? Assuming ideal conditions with no scatter or reflection of signals, an infinite degree of isolation could be achieved between vertically polarized and horizontally polarized signals occupying the same channel. Since this isn't usually the case for the average ham, the number may be something finite and measurable.

In tests that I have run over the years, casual observation would indicate that as much as 20 dB or so difference is commonplace between stations with similar antennas 90 degrees apart from each other. How about that same operator mentioned earlier with a simple vertical trying to work a station with a simple yagi? To answer this question, I set up a test range in my backyard to see the results, using my KLM and a selection of vertical mobile antennas.

The first setup looked like this: An ICOM IC-2AT was attached through a Bird 43 with 5-Watt slug to a Larsen magnetic-mount antenna, using a 5/8" whip. The antenna rested on an aluminum plate to yield a ground plane. All of this rested on a garbage can atop a wooden stool. Photo A shows this elegant setup. About 40 feet away, I fastened the KLM beam to my tower about 6' above ground in a vertical plane (Photo B). The output from the beam was fed to a Boonton Electronics Model 92 rf millivoltmeter with 50-0hm terminated probe (Photo C).

I used the wattmeter solely to establish the presence of a stable signal from the 2AT. After keying the hand-held with a switch into transmit, I logged the readings from the millivoltmeter. The reading was +2 dBm with the hand-held running 1 Watt output. Next, I turned the KLM 90 degrees and remounted the clamps (Photo D). After careful aiming and peaking, I logged a reading of −17 dBm, a net loss of 15 dBm of signal—over 2 S-units. Pretty substantial!

Next, I switched to a quarter-wave Larsen radiator (Photo E). With both antennas in the vertical mode and running 1 Watt output, I logged a reading of −1 dBm on the meter. Rotating the KLM beam horizontally then resulted in a reading of −14 dBm, a net loss of 13 dBm of signal. (Incidentally, this test also showed, in a crude fashion, that the 5/8-wave antenna exhibited gain of about 3 dB over the quarter wave.)

What if I used an improper radiator? A 220-MHz quarter-wave radiator—not resonant at 2 meters—was connected. In the vertical mode, I noted a reading of −7 dBm. When the KLM was rotated

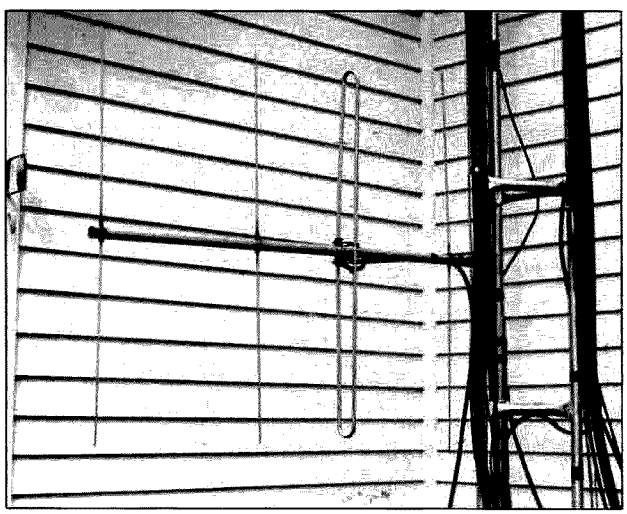


Photo B. The four-element KLM beam is connected to the tower and is vertically polarized. Output from the KLM beam is fed to an rf millivoltmeter.

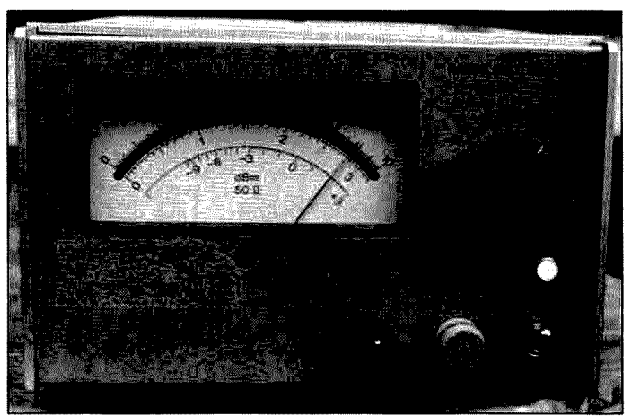


Photo C. Rf millivoltmeter measuring output from the 5/8-wave Larsen antenna in a vertical plane.

90 degrees, the reading changed to −23 dBm, a loss of 16 dBm . . . almost 3 S-units. There was a pattern of sorts here. Note that I expected and noticed substantial reflection from objects around the KLM beam (including myself), much as might happen in the average amateur installation.

All right, let's put two and two together! Fact #1: SSB and CW modes aren't called "weak-signal modes" for nothing. Most of the signals you will encounter in this operation are many miles distant, using moderate- to high-gain yagis and 99% are horizontally polarized. Fact #2: When operating these modes, you'll often find an average signal level of S3 to S6 to be quite common. Conclusion: It's hard enough work to copy a station running S2 to S3 out of the noise while on SSB or CW. It's pretty well impossible to copy a station in the noise! Lose 12 to 18 dBm of that weak signal due to polarization losses, and you've lost the battle before it's begun.

The moral? If you plan to try some SSB or CW work on 2 meters, give it an honest shot and use a horizontally polarized yagi with some gain. Take that same weak signal, and you'll pull it right up out of the noise to Q5 copy with a 10 to 14 dB gain yagi.

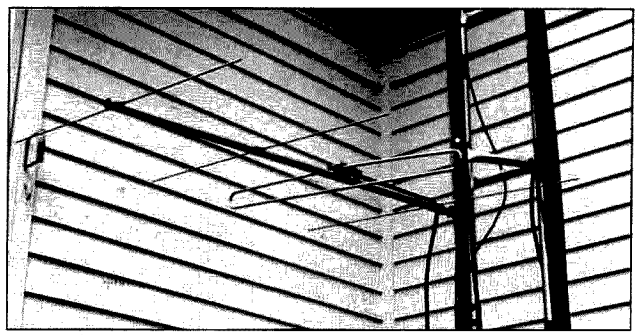


Photo D. The KLM beam in a horizontal plane.



Photo E. The test rf source, an IC-2AT, feeds a Larsen quarter-wave antenna. A Bird 43 monitors steady output.

Feature Dept.

I haven't featured anyone lately here, but a recent purchase brought a supplier to my attention that may help you as well. Kentronics, located in New Jersey, is a surplus test equipment store with a huge stock of goodies. The proprietor, Brian Kent, was helpful in locating a 50-Ohm BNC coupling for the previously mentioned Boonton rf millivoltmeter, allowing me to take signal measurements directly from antennas. He has a nice selection of used scopes, signal generators, and other test-bench material in good condition. Brian is located at PO Box 2444, Allaire Airport, Farmingdale NJ 07727, and his phone number is (201)-681-3229. Brian travels to many of the major hamfests (including Dayton). Just look for the fellow with the cigar amidst Tektronics scopes. Maybe he can help you as well.

Mailbag

Ron Manfredi WA2EIO of Merrick, New York, inquires about antenna changeover relays. Boy, have they gotten out of hand! Dow-Key division of Kilovac Corporation in California, makers of the familiar Dow-Key antenna relays for HF operation, also manufactures a line of relays for high-power VHF and UHF operation. Hold your breath, though; they will set you back about $200 for DPST types and $180 for SPDT types. A better way might be to consider plowing through flea markets for used units (they *do* surface from time to time). EME Electronics of West Germany makes an excellent UHF-type relay with N connectors. It's good for 1,500 Watts at 144 and 220 MHz, and in excess of 1,000 Watts at 432 MHz.

Coil voltage is 12 V dc, and the units are available in SPDT configuration with and without external contacts. Prices range from $115 to $130, depending on contact arrangement. Contact the U.S. importer (The PX Shack, 52 Stonewyck Drive, Belle Mead NJ 08502) for further details.

Arturo Nelson XE1FV writes from Guadalajara, Mexico, to ask why I didn't include the Yaesu 726R in my comparative review of the ICOM IC-471A and Kenwood TS-811A (June, 1986). The answer is easy: I couldn't locate one from an area ham at the time! These units were not purchased for the test, nor did they come from the manufacturers for evaluation. I simply located two local amateurs with the units who agreed to lend them to me for the comparison. This way, I'd be sure to get something off the shelf without paying for it (cheep! cheap!). I am aware that the 726R is a very popular unit, and I do plan to obtain one shortly for evaluation. Then I'll plug the numbers into the comparison chart to see how it stacks up against the other two contenders.

Arturo uses his for OSCAR operation primarily, although he's in the process of putting up antennas for weak-signal DX operation on 144 and 432 MHz. A harsh noise environment has prompted his construction of stub and cavity filters for 144 MHz (welcome to the club, Arturo!). This is probably one of the more infuriating things you can encounter as an active VHFer. I know, because I fight it every winter, usually during the January VHF Sweepstakes! This is why I've gone to an ICOM 740S with transverter for the bulk of my 2-meter contest activity, since the 740 has an outstanding variable noise blanker. Between precipitation static and space heaters, it's a running battle to keep the QSO rate up. I'm not surprised that the noise blanker is inadequate in the FT-726R as Arturo reports—very few of the Japanese VHF multimodes have a decent noise blanker. The problem is that using one fixed setting for various types of noise won't work. ■

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"About two[illegible]ught an Isotron 80 and just recently got it out of t[illegible]p [illegible]-foot pole. I am really intrigued by it a[illegible]t often trying to convince other stations that it is o[illegible]igh. I worked California when it was hanging by a [illegible]the ceiling of the shack and it works even better[illegible] WB6EDF" (Photo: Isotron 160)

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AERO MEXICO CRASH

ARES preparedness in Orange County, California, was put to a test on Sunday, August 31. An Aero Mexico DC-9 jet on approach to Los Angeles International Airport collided with a single-engine Piper aircraft in the skies over Buena Park, a Los Angeles suburb. Both aircraft plummeted to the ground in the adjacent city of Cerritos. The DC-9 fell into a housing development, while the smaller aircraft crashed into a nearby schoolyard. All passengers and crew on the Aero Mexico jet and the three people in the Piper were killed. More people died as burning debris from the DC-9 destroyed 17 homes.

Amateur radio's involvement began when an official alert was called, activating the Orange County Red Cross and the Orange County Amateur Radio Emergency Service. ARES was to provide primary communications for Red Cross relief efforts. Using the facilities of the N6ME repeater on 145.40 MHz, the Red Cross Santa Ana Chapter amateur station WB6QDG was activated and it soon became the hub of Red Cross relief activities. Amateurs equipped with two-meter mobile and hand-held gear were dispatched by radio to the disaster site to coordinate communications for Red Cross operations. They also aided the communications of other disaster agencies. The operators performed like a well-oiled machine, proving again the value of regular emergency drill sessions. It appears as if two dozen or more Orange County ARES members were called into service before net management was transferred to the Long Beach Red Cross chapter office. Ancillary communications used the facilities of the KC6K 146.97 repeater in nearby Anaheim.

About an hour after activation, Net Control WB6QDG put out a call for mobile and portable packet stations. They were desperately needed at the crash site to handle high volume written traffic. With none initially available in the immediate area, hams from further away offered their services. One was a mobile packet station in a recreational vehicle in Riverside some 75 miles from the crash. The other was an operator with a battery-powered portapacket system in Pasadena. One was ordered to the Santa Ana Red Cross chapter building and the other to the disaster site. As word of the disaster filtered down to the digital community, local packet stations joined the traffic net. One of the few problems noted was that poor communications exist between the digital and analog factions of the local amateur community. We were told that most digital enthusiasts spend little or no time monitoring local voice communication. Several people have already told *Westlink* that this situation will quickly be corrected.

Even in a time of disaster, the southern California kook corps had to come out of their ratholes and add to the grief. During the emergency communications on the N6ME repeater, there were several incidents of malicious interference. The net control and the operators ignored the jamming and most of the interference disappeared after what appeared to be T-Hunt teams gave the names and callsigns of the alleged jammers over the air. Maybe this is the only way to handle the spoilers.

Analysis

I first heard about the mid-air collision from Joe Merdler N6AHU. A quick call to the newsroom of the television station where I work confirmed that the accident had taken place, and I quickly tuned to CNN Headline News to see if they had any further word. Nothing there, but KCBS had interrupted normal programming and already had live pictures from the crash scene. Almost immediately I saw a ham talking into an FT-208R. Ham radio was on the scene as a part of the rescue and relief effort.

ARRL Division Director Fried Heyn WA6WZO has spent a lot of time in building up a functional ARES operation in the Orange County area. Fried had started the job long before he was elected a League Director. The Orange County group has their operation down to an exact science. A few phone calls confirmed that it was Orange County ARES that had been activated to provide ancillary communications to the Red Cross. I learned the frequencies in use from April Moell WA6OPS. Being separated from the activity by a pair of mountain ranges, I plugged the numbers of the N6ME system into a private UHF remote base and began to listen and record.

What I heard made me proud to be a ham. The hams aiding the Red Cross relief operation utilized a minimum amount of talk to transfer a maximum amount of vital information. You could tell that the operators had spent their drill hours wisely. Their performance was all but flawless, proving once again the value of regular training exercises. However, this tragedy did point up two important negatives that require discussion.

Problem 1

The first problem was obtaining packet stations locally for dispatch to the disaster area and the relief coordination sites. As those of you who read last August's issue of *73* are aware, a vast network of packet operation has its own hub in the Los Angeles/Orange County area. In fact, packet is the fastest growing mode of amateur communication in California. There are thousands of packeteers already on the air, and hundreds of new stations are coming to the mode every week. So why, with all of this activity, should there be any problem in obtaining operators and gear?

The answer can be summed up in one word: specialization. As explained to me by fellow *73* columnist Harold Price NK6K, the "digital folks" and the "analog folks" have no common meeting ground. That is, the digital community spends little if any time monitoring any local voice communications, and voice-only operators who have no packet gear have no way to communicate with the digital-only groups. You can see why a problem with obtaining instant portable and mobile packet stations might arise. Harold feels that this problem can easily be overcome with a simple exchange of phone numbers, but I feel it has to go a lot further than that.

If packet radio is as important in emergency service work as it appears, then it is a must that all ARES groups have all their members packet-equipped—or if this is not economically feasible they should develop a second, parallel "Digital ARES Network" by either absorbing or utilizing the services of an existing packet group. This means that an NCS or other individual in a position of responsibility must be equipped with both digital and analog gear, and have the ability to operate both simultaneously or through a second, parallel NCS.

The overwhelming need for packet in the aftermath of this disaster is definitely an indicator of things to come, and while packet will never completely replace voice, the latter may soon become subservient to the former in situations where a high volume of written traffic takes place. The only variable is the human typing the traffic into the terminal or the computer.

Even though I am not yet active on packet, I am convinced that it will become the backbone of local, regional, national, and international traffic interchange within only a few short years. The digital transponder on board the new Japanese amateur satellite, Fuji (which the AMSAT folks call Japan OSCAR 12), is only a sample of what's to come. I am willing to say that packet will be the key that fits the coffin marked "Morse code." Packet will lock and eventually bury that box forever.

Red Cross and RACES take note. Packet is not the "wave of the future." Rather, it's the "wave of the present," and it's the most logical answer to your high-volume written communications needs. If you are not equipped with it, it's time to get your act in gear. If you have been awaiting proof of need, that proof is now here. An emergency phone-up list of available local packeteers can only be a temporary expedient. For packet to become a fully functional part of emergency communications, its operators must involve themselves in ongoing weekly training exercises, and an integrated radio call-up system must be developed that alerts the digital folks of a communications need at the same time that it gives this alert to the voice communications people.

Problem 2

Now to the other problem noted during this emergency: wanton and malicious interference to communications on the N6ME repeater during the emergency relief effort. You would think that in as tragic a situation as this even the worst of the nut cases would

have some respect for the dead and dying. Well, in an area where jammers consider themselves to be an elite corps, and where everything has been tried—including prison terms—to end jamming with only a modicum of success, what can you expect. I have long maintained that the real key to ending the problem is to never permit "a certain amount of jamming" to become the accepted norm. Well, in the Los Angeles area, accepting a certain amount of jamming appears to have become an acceptable standard of operation on the two-meter band, and it's the main reason that I spend very little of my time in Los Angeles on two meters. On the other VHF and UHF bands, no level of malicious interference is tolerated, and the rumor mills run rampant with stories of why "this jammer or that is now hospitalized." In fact, it's rather reminiscent of two-meter FM in New York City in the late 1960s. For the pacifists out there, I am not condoning violence. In fact, I cannot even say for certain that it has taken place. Maybe it's just all rumor and innuendo started to keep the fanatic fringe in its place. Whatever it is, it works.

But that's 220, 450, and other bands, not two-meter FM in Los Angeles. So, it was almost with amazement that I heard a transmission similar to this: "This is W6XXX mobile. I'm parked outside the home of NX6XXX and he is jamming the emergency communications." A definite statement of fact from a member of a T-Hunt team. Not one of those "I think it's NX6XXX" type transmissions from a base station 30 miles away. And the result? Silence from the jamming station. I can only hope that what this is really saying is: "We in southern California have had it with you jammers, and we are just not going to take it anymore! See you in court, jammer." It's about time.

"Even in a time of disaster, the southern California kook corps had to come out of their rathoies and add to the grief."

Fuji

There is a rather interesting aside happening between AMSAT and the Japan Amateur Radio League. It's not a knockdown, drag-out fight, but nevertheless it's taking place and it's over the name of the newest amateur satellite. Before its successful launch in August, we all knew the bird by the same name. It was called JAS-1. Some places wrote the name as "Jazz-One," but at least everyone was content with the one name. On August 12, that all changed. From JARL HQ in Tokyo I received the following telex message: "The H-1 rocket carrying the first Japanese Amateur Satellite JAS-1 has successfully lifted off at 20:45 UTC 12 August 1986 from the Tanegashima Space Flight Center." A few hours and several telex messages later, the following confirmation of success reached the *Westlink* newsroom, reading in part: ". . . new born satellite JAS-1 was named 'Fuji' by JARL today. Please call it 'Fuji' from now on. . . Shozo Hara, President - JARL."

That seemed simple enough. The JARL and its associated organizations designed, built, and orbited the bird, so as far as I was concerned it was theirs to name as they pleased. Why should anyone want to interfere? I really don't know the answer, but you might want to ask AMSAT since they insist on calling Fuji "Japan OSCAR 12," or more simply "JO-12." This apparently upset the Japanese more than a bit, and probably accounted for the delayed but emphatic follow-up telex bearing the Fuji designation.

Anyhow, the AMSAT folks appear to be adamant that they will be the ones giving Fuji its name, and as of September 1, 1986, the name that AMSAT is sticking with is JO-12. AMSAT's *Amateur Satellite Report* of this date fails to take note of the JARL preference for the Fuji designation. Who will eventually win this low-key international battle of the satellite name? In this case, I'll put my money on the Japanese. After all, it is their satellite, and they should be permitted to call it anything that they want. Who knows, maybe by the time you read this the satellite will have a single and accepted moniker.■

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73 INTERNATIONAL

Number 27 on your Feedback card

NOTES FROM FN42

Zambia has joined us this month and 73 International now covers the world from A to Z! Now how about the only four (possible) missing letters in between: O, Q, W, and Y? The three can be only Oman, Qatar, and Western Samoa (an independent state) but either the Yemen Arab Republic (North Yemen) or Yugoslavia would cover the last. We are waiting. . . .



BRITISH WEST INDIES

Roger A. Corbin ZF1RC
Secretary Cayman Amateur Radio Society
PO Box 1549
Grand Cayman
British West Indies

Have you been wondering why you did not receive a OSL card from your contact with a station using a ZF call? Here's the explanation, and some additional information from a lovely spot in the Caribbean Sea.

ZF2 callsigns may be used only when an operator is in the Cayman Islands. An operator who signs /ZF2, portable ZF2, or ZF2 maritime mobile is operating illegally and QSL cards received by the bureau operated by this club for stations using the above calls will be destroyed.

A year ago this month (November) a station using ZF1RC with an operator calling himself Ron was operating illegally, and a number of amateurs seeking QSL cards now cannot be served. To compound the confusion, that was the call assigned to me a month later, on December 21, 1985.

The Cayman Islands do have reciprocal licencing agreements with a number of countries, including the United States, but sometimes we get left off the lists. It may appear to many amateurs that it takes a very long time to get a response to QSL cards sent through the local bureau. This is due mainly to the fact that most of the ZF2 operators visiting our country forget to make arrangements for cards to be forwarded. We are taking steps to try to correct this situation. This club now operates an open repeater on 146.76 with a 600-kHz negative input frequency. The simplex frequency most regularly used locally is 146.52 MHz. 73, ZF1RC.



CANADA

Dean Milner VE1CBF
28 Castle Drive
Sydney, Nova Scotia B1S 2A2
Canada

Canada returns to 73 International after an absence of nearly three years. . . but was well-represented during that period in other parts of the magazine. Our new correspondent, VE1CBF, would like to know what readers would like to hear about. Let us know here at 73 (mark for "International Editor") or, if you write him directly, send us a copy of your letter so that we can know, too! Time and space constraints for this issue made it necessary to pass on only the following from his first report.

The Canada Day Contest in July showed again a noticeable increase in participation of amateurs from outside Canada, some seeking points toward the Canadaward. The next Canada Contest will be, as usual, on the last weekend in December. For a copy of the rules and/or more info on the Canadaward, write the Canadian Amateur Radio Federation (CARF), PO Box 356, Kingston, Ontario, K7L 4W2, Canada.

The fight continues in the case of Jack Ravenscroft VE3SR, off the air per a court injunction "as he was creating a nuisance. . . by interference to electronic appliances" in a neighbor's home. An appeal has been filed against the liability finding and damages awarded, and the case is being followed closely by the Department of Communications and all rf spectrum users. Jack's legal expenses currently stand in excess of $15,000, and he is grateful to amateurs from other countries who have made contributions to the Jack Ravenscroft Susceptibility Defense Fund (PO Box 8873, Ottawa, Ontario, K1G 3J2, Canada) to help him out. He also is grateful for the moral support he has received through letters.



CUBA

Eduardo Fernandez Rodriguez
Presidente, Federacion de Radioaficionados de Cuba
Apartado Postal No. 1
Habana 1
Cuba

We welcome Cuba to 73 International; Rafael Fernandez CQ2RX will be our correspondent. Sr. Fernandez is the FRC officer responsible for liaison with the IARU and knows a lot of amateurs who can supply him with items for this column.

We have the Cuba DX Group (G.DX.C.) created about one half year ago which has about 55 hams. We have a certificate for those who establish two-way contacts with four members of the group. The FRC invites you to join the Group for life membership. For 30 IRCs or US$10 we will send you a membership certificate, decals from the G.DX.C. and FRC, a G.DX.C. pennant, an FRC pennant (all these in full color), a personal unit number, postcards and stamps of Cuba, and a roster of members. Your station will count 1 point for the G.DX.C. Award.

With your application (send to the above address) let us have your full name and address, DXCC countries confirmed, itemized list of your equipment and antennas in use, bands and modes you operate, languages you speak, and let us know: Do you QSL? Have you been on any DXpeditions as an operator? Do you have any of the following awards: DXCC, WAS, WAC, WAP, WPX, WAE, AAA, ADXA, DUF, BERTA, Cuba, G.DX.C., Caribe and/or America (see some of these described below)?

Concerning visitors, we have had Canadian, German, Spanish, and Bulgarian hams who have operated our club equipment and made many contacts. If anyone wants to visit and operate, we recommend you let us know two or three months in advance to make the necessary coordination with the Frequency Management Authority in order to get a provisional license—or you could write direct to: El Director, Direccion de Frecuencias Radioelectricas, Ministerio de Communicaciones, Plaza de la Revolucion, Habana 6, Cuba.

Concerning the growing of amateur radio in our country, it is going on. For instance, in 1981 we had 315 members in our Federation who were licensed to transmit and in 1986 we have 730 members with 464 licensed to transmit, and we have 534 licensed stations, 18 of which are club stations.

We have a QSL Bureau, of course; it is at the FRC address.

Cuban prefixes are CM for second class stations or Novices and CO for first class stations and Juniors. CL and T4 are for special events only.

South of Cuba is a key called Cayo Largo which is a wonderful place for DXpeditions, tourists, and rest, for which a visa is not needed—it is possible to arrive there direct by plane or ship. I would be happy to provide additional information if you would like.

[*Editor's Note: Remember always to send IRCs with letters you write as a result of information you read in these columns, when you are asking for replies.*]

AWARDS

For OMs and SWLs, SSB, CW, 1 band or 5 bands, do not send QSLs but only list of contacts including date, time, band and mode (certified by your radio club or two licensed hams), with 10 IRCs or US$2 per award; mail to Award Department, G.DX.C. at above FRC address: Cuba Award.Work (hear) the eight districts of Cuba (CM1–8, CO1–8); up to three missed districts may be substituted for with radio club stations. Use three suffix letters. America Award. Work (hear) countries and islands in America. Class III (category C) 30 countries and islands; Class II (category B) 40; and Class I (category A-Excellent) over 40. G.DX.C. Award. Work (hear) four members of the Group, any nationality. Identify with QSLs. For the Caribe Award, any mode, any band, work (hear) countries and islands in the Caribbean, including XE, VP1, TG, HR, YN, TI, HP, HK, and YV. Class III (C) 20–24 countries and islands; Class II (B) 25–29; and Class I (A-Exc.) 30 and over.



CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

Cyprus on paper seems to have a very large number of amateurs compared to its population. There are nearly 500 licenses to a population of about 650,000, but unfortunately the really active amateurs on the HF bands are not more than a dozen. Most amateurs are on VHF or they gave up the hobby, changing to another one. There is, however, an encouraging factor. During the last radio amateur examinations quite a few young people got callsigns. Some of them are harmonics of old amateurs, one of them being my second harmonic, John 5B4TZ, who is going to operate on HF regularly.

Catching you up with news of Cyprus: In 1985 was the 25th anniversary of the Cyprus Republic, and Cyprus amateurs were given the special prefix of 5B25 for use between August 17th and December 31st. This gave the chance for many amateurs to work this prefix and the 5B4 activity was increased at the same time. Unfortunately no award was programmed for the occasion, but the old Cyprus Award is still available.

Some of the specialized modes have started to be in use by Cyprus hams. On RTTY-Baudot we have (5B4)OK, OA, OP, NA, NG, IT, MC, and MD in Nicosia, JE, OV, and CV in Limassol, and CR in Larnaca City. On AMTOR, we have in Nicosia MD, OA, OK, FN, and IT. They are still experimenting and also use auto-AMTOR.

The master of satellite communications is undoubtedly Akis 5B4OA, who is QRV regularly on OSCAR-10. Others active on satellites are Spyros 5B4MF and Andreas 5B4LP, who operate from their school club station, 5B4ES.

On SSTV we have Nicos 5B4CV as our number one, and (5B4) HF, OA, MD, and OK.

On the VHF scene we have Andreas 5B4LP, who is the only one operating meteor scatter, and in 1985 he had fine contacts with UB5 and 9H1. On sporadic E, 5B4 hams had successes with LZ, YU, SP, HG, UB5, and I. During the recent June sporadic E opening, Nick 5B4AZ, using only a handheld and 1/4-wave telescopic whip on his FT-290, worked about ten stations from Italy.



Peter G4UIK operating from 5B4JE's shack as G4UIK/5B4.

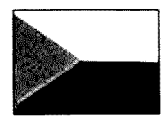
On tropo during the summer, contacts are quite easy between 5B4 and all the neighboring Middle East countries. All Israeli repeaters can be accessed and also the Amman repeater in Jordan sometimes. Simplex QSOs are also made with OD, 4X, JY, SU, SV5, and SV9 lands.

Although contesting in Cyprus is not so popular with the majority of amateurs, regular participants in various contests include 5B4MF, 5B4LP, 5B4DN, 5B4NC, and 5B4ES. Their results were very good, and at the last annual General Meeting of the Cyprus Amateur Radio Society, Spyros 5B4MF and Andreas 5B4LP were awarded honorary plaques in recognition of their activity and promotion of the hobby.

During the past few months many foreign amateurs have visited the Island and met many local amateurs. Mike A71AD came in May and has now settled in Nicosia, operating with the call 5B4TI. Also visiting Nicosia, SV5RW and OH8MA. In my own shack this summer, I had Jim GM4HKW, Peter G4UIK, Rudi DJ0MAF,Alecos SV2QO, Peter OH1RY, and Amir 4X6TT. It is always a pleasure to meet hams from other countries, and if anyone is visiting Cyprus, do not hesitate to contact 5B4 hams.

ZC4 activity is regular, especially on CW. From Akrotiri base, the most active is Adrian ZC4AP, and from the Dhekelia base, ZC4MR and ZC4EE. In the very near future the Episcopi club station, ZC4EPI, will be operational, and the secretary, ZC4DA, informed me that 5B4 amateurs of the Limassol Group will be allowed to operate from their club station as associate members. So I hope that I will be operating myself from there as ZC4EPI and enjoy the pileup.

Last item is the announcement of the operation of a new club station in Limassol, 5B4BBC. It was founded by the ham employees of the BBC relay station in Cyprus, and its first president is Andy Matheson 5B4DN, who also is ZC4AM.



CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Gogol'ova 1882 955 01
Topol'cany
Czechoslovakia

As this is being written, all four semifinalists in the U.S. Open Tennis Tournament are Czechoslovakian. It seems safe to predict that the men's and women's champions will be Czechoslovakian! Congratulations, Czechoslovakia!

Czechoslovak radio hams sincerely invite American hams to take part in our OK-DX Contest;



Ferdo OK3CXW DXing on 80-meter SSB.

the general level of the contest will be raised by your participation. It is scheduled for November 8–9, Saturday and Sunday, 12 o'clock to 12 o'clock UTC (being the usual 2nd November weekend). 1.8–28 MHz on CW/SSB. Contacts OK on same band for CW and SSB. CW: on 20 and 80, use the 3.500–3.560 and 14.000–14.060 windows for CW; SSB on all frequencies. Band changes only after a 10-minute minimum on one band.

Three points for contacts with OK and OK4/MM stations, one point for other contacts (except no points within your own country). Multipliers are zones according to the ITU list, on each band separately. Total score: all contact points times all multipliers. Categories: single operator, single band; single operator, all bands; multi-operator, multi-bands.

Send logs in usual way, reports and ITU zone, before the end of November, to Central Radiociub, PO Box 68, 113 27 Praha 1, Czechoslovakia.



EL SALVADOR

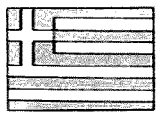
Marco A. Orellana YS1OD
PO Box 464
Calle Progreso 3332
San Salvador
El Salvador

Welcome to YS1OD! More from him in the future, but in the meanwhile he wants us to know. . .

I'll be glad to be [the El Salvador correspondent] and help any ham who has interest in visiting El Salvador for a short, medium, or a long period, as visitor or temporary resident. In case some DXpedition wants to operate from this country, I will like to have all the information at least 60 days in advance in order to do all the paperwork for the government and also to get prepared to welcome them.

We have two QSL Bureaus: Radio Club YSDX, PO Box 05–43, Metrocenter, San Salvador, El Salvador, and CRAS QSL Bureau, PO Box 517, San Salvador, El Salvador.

If any ham needs information about how he can operate here, he can contact me at the above address; telephones: direct international dialing: (503) 23–8183 or (503) 24–3954.



GREECE

Manos Darkadakis SV1IW
Box 23051
Athens 11210
Greece

In my column last January, I have told you of some of the problems we often have with illegal operations from Mt. Athos. Now I am going to tell the legend of Mr. Frank Turek DL7FT and his efforts to put this rare country on the air.

This year, as in 1985, he wasn't even inside Mt. Athos territory but operated from somewhere outside, as usual. Of course he says always that he was inside and that he had a license for that and all those good things to hear, but the truth is rather different. He never had and never will have a license other than the "Diamoneterion" (staying permit) which says one may visit and be in the monasteries for religious purposes only—and he may not even have had that since you don't need it if you never go inside Mt. Athos.

Last year we made a protest to the German PTT. This year we are going to have reciprocal agreements between West Germany and Greece reconsidered.

We remind you that the law covering amateur radio operation in our country for Greeks and foreigners clearly states: in order to get permission for amateur radio transmissions from the Holy Mountain, the applicant needs a written permit from the Holy Community of Mt. Athos as well. (From Legislative Decree 271 of 30/April/76—Official Gazette 102/B.) Furthermore, we strongly believe that certain rules have to be obeyed when somebody is participating in the DXCC Award (paragraph 12 covering operating ethics).

Mr. Turek went also a little bit further this year. He tried to throw mud on our operation back in 1980 (SV1DC/SV1IW/SV1JG), saying he had proof that we were operating from a hotel . . . but he didn't care! (What a big heart he has!) The least we can do is to show our pictures: one of the "the hotel" with the 12AVQ on top of it, and one of SV1DC's head popping up through "the hotel's" roof!

The story goes on with DL7FT in SV5 for a new expedition from May 3 to 25. He announced it as mostly to give a new one to the Japanese. He also promises to go again to Mt. Athos after SV5 in order to take care of those unlucky ones who missed him the first time.

On the other hand, the RAAG (the Greek association) received a letter from our PTT stating that the license of Mr. Turek has been revoked as of April 24, 1986 (see Fig. 1). The reasons are clearly stated. The police then began looking for him on Rhodes in order to stop his activities, but he couldn't be found anywhere. Meanwhile he continued running his expedition despite the fact that three Greek and some German operators told him to stop because of the PTT decision.

To make a long story short, DL7FT was found on May 21 at the Ramira Hotel on the island of Cos, the second most populated among the twelve Dodecanese islands. You see, he got his license for Rhodes but went on to Cos . . . you may imagine why.

His operation was stopped and his radio was sealed and kept at the airport customs office to be given back to him at his departure from the country.

And now the grand finale! During a conversation with Don Search, Don told me that DL7FT had provided him with all necessary papers including a Mt. Athos one just like the one I had in 1980 for my trip! Since all papers arriving at the DXCC desk are treated as confidential, Don couldn't do more than provide me with permit numbers and dates.

A letter was forwarded to a friend of mine in Mt. Athos the next morning with all the details in it, and a few days later the matter was revealed. The Mt. Athos community had never issued such a license, Mr. Turek was unknown, and most important, the protocol number did not match with those issued by the community.

I leave the conclusions to you. Not hard to guess.

Common sense now says that it will be even more difficult to get a written permit for Mt. Athos again after all these sad events. We hope we will not have to face the unhappy situation of seeing Mt. Athos among the deleted countries. We believe we should have nothing more to do with DL7FT's operations; we regret that a DXCC Honor Roll holder should have provided such an example to younger DXers—making the DX-CC certificate look like a piece of worthless rubbish.

By the way, I will be glad to forward any documents to anyone who would like to look at them. Please do not bother the editors of *73* but send your request, if any, to me direct.

GREEK DEMOCRACY
MINISTRY OF TRANSPORT AND COMMUNICATIONS
DEPARTMENT OF POST AND COMMUNICATIONS

ATHENS 24/4/86

Ref.No. : 58869

Degree of priority : VERY - URGENT

POSTAL ADDRESS : 49,SYNGHOU AVE.
POSTAL CODE : 11780 ATHENS
FOR INFORMATION: Mr.N. CHRISTOPOULOS
TEL : 923.2906

TO:
The Security Dept.of Rhodes,
85100 RHODES
NOTIFICATION TO : Radio Amateur Association of Greece,
P.O.BOX 3564 Athens 10210

MATTER IN HAND : REVOCATION OF TEMPORARY LICENCE FOR OPERATING AMATEUR RADIO STATION.

We acknowledge that in our letter (ref. no. 52352/29-1-86) which was also sent to your office we granted a temporary licence for possession and operation of an amateur radio station to the German radio amateur Mr. FRANK TUREK.

Since the aforementioned, in accord with a written report made by the Radio Amateur Association Of Greece, exhibited wrongful behaviour toward the Spirit of Amateur Radio violating even the current regulations (such as using a false call-sign, a phoney declaration that he was transmitting from Mt. Athos which is forbidden,making sarcastic and derisory remarks to Greek Amateurs etc.) Our Department revokes his licence which it had granted.

Therefor,since Mr. Turek in his application said that from 3rd to 25th May he could be in RHODES,we request that you locate him to take away his licence for possession and operation of his amateur radio station (ref. no. 52352/29-1-86) and to seal up his radio equipment which is an ICOM transceiver model IC-730 serial no. 06027, so that he will not be able to use it until his departure from Greece.

Our Department will at the same time notify the corresponding German Ministry.

The Supervisor of Ministry Of Transport and Communications

S.BARABOUTIS

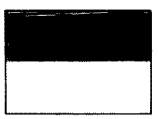
Fig. 1. The revocation notification.



SV1DC prepares to erect the antenna on the monastery roof, 1980.



The erected antenna at Mt. Athos, 1980.



INDONESIA

Erlangga Suryadarma YBØBZZ/V85BZ
ORARI National OSL Bureau
PO Box 96
Jakarta 10002
Indonesia

August and September report by YBØBZZ and Ben S. Samsu YBØEBS.

The International Beacon Proj-

ect (IBP) has not been considered by ORARI [Organisasi Amatir Radio Indonesia] at the present time. However, realizing that the present established IBPs in IARU Regions I, II, and III are well spread geographically [and] Indonesia is strategically situated at the intersection of two major continents and two major oceans [it] is also a "mid-point" [and a] suitable location. Should there be any plan within the IARU Region III association in this matter, ORARI will highly extend its support and cooperation.

[ORARI plans to add to its calendar of annual events an International QRP Day, probably on June 17 since that is the day so proclaimed in IARU Region I. This is because of the new feeling of "the bigger the better" resulting from the increase of imported equipment and bigger antennas and bigger power.]

It is the opinion of ORARI that whilst some of the world contests such as *CQ* WW have a very strong foothold in the world amateur activity, it is of great pity that the one and only World Amateur Radio Day was not celebrated by all amateurs accordingly. ORARI wishes to appeal that this special day should be programmed . . . as the most important and greatest event, and all IARU society members [think of themselves as] obliged to participate.

ORARI wishes to support the establishment of a common frequency preserved primarily for DX requirements which in no condition except for emergency communications will be utilized for local communication. This will preserve also the segment for DX contest purposes, as, at present, it tends to be fully blocked by local communications in that segment. Example of this is the usage of DX-window segment in the 80-meter band.

This report will conclude next time with a section on the new band plan.



ISRAEL

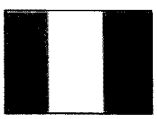
Ron Gang 4Z4MK
Kibbutz Urim
Negev M.P.O. 85530
Israel

FLASH!

Easter in the Holy Land with the Holon-Bat-Yam Club! [You can be there!] In the last edition of this column I reported on the week-long 4X5J operation of the Holon-Bat-Yam radio club, ending my comments by stating that I didn't know what they had up their collective sleeve for the coming year. Since then, the dust has cleared and it has become evident that they really intend to outdo themselves for this coming spring. Thus, I have the pleasure of announcing to the readers of *73* their project, which will consist of the simultaneous operation of five stations bearing special callsigns, from five separate locations: Bethlehem, Jerusalem, Nazareth, Mount Tabor, and the Mount of Beatitudes (above Capernaum on the Sea of Galilee). The operation is to take place from the 23rd through the 30th of April.

In order to man these stations around the clock, the club is looking for 50 or more overseas radio amateurs, who are invited to come with their families, who will take turns operating the stations, and will be sightseeing on their days off. Operators should be experienced in handling pileups and preferably should know how to make QSOs in a few languages. Those interested in this combination of holiday and hamming should write to Aharon Kirschner 4X4AT, HaRakefet 17, 58204 Holon, Israel.

As with the Holon-Bat-Yam Club's 4X5DS (Dead Sea) and 4X5J (Jerusalem Old City) operations, special QSLs and certificates will be sent free of charge to those making contact with the Easter-1987-In-The-Holy-Land stations.



ITALY

Manuel F. Calero I4CMF
Manager, IARS Reciprocal Licensing Unit
Via Giorgione, 16 I–40133
Bologna
Italy

Herewith additional information from the IARS [International Amateur Radio Service]; see 73 International *for July, 1986, also. The IARS was founded as a private, nonprofit organization by I4CMF and I4OCS for the aim "of promoting friendly relations between radio amateurs throughout the world by assisting in negotiating reciprocal licensing agreements between Italy and other countries." The organization "considers the six universally recognized and accepted articles of the Ham Radio Code [Paul M. Segal—see any edition of the* ARRL Handbook*] to be the guideline for their activity, with mutual respect for each person's rights and duties."*

The latest country with which Italy has reached a reciprocal licensing agreement "is the 'oldest' and 'noble' Republic of San Marino, very well known also as 'Monte Titano' (Mount Titan), from the name of the main peak of the land. We are very happy to give you this news because this agreement is the first one that our 'small' neighbor has reached in its history of radio amateurs."

Eighteen other countries have such agreements with Italy. The IARS emphasizes the need to observe all "bureaucratic formalities which, unfortunately, continue to exist because each country still continues to carry along its own set of regulations. However, it is hoped that with the institution of the 'European' license, promoted by C.E.P.T., free circulation rights will be granted to European ham operators. This objective is a particularly important one which IARS is committed to and which it is counting on achieving soon. The goodwill and desire to work towards a goal which will bring OMs throughout the world a little closer together, with no distinction of race, nationality, or creed, is certainly NOT lacking!"



ZAMBIA

Daniel E. Soko 9J2DS
PO Box 71831
Ndola
Zambia

Welcome, 9J2DS, Secretary and Awards Manager for the Radio Society of Zambia. We will be pleased to hear more from you not only about Zambia but your neighbors also: Tanzania, Malawi, Mozambique, Zimbabwe, Namibia, and Angola, and even more distant neighbors in southern Africa.

At present, Zambia has 30 licenced radio amateurs, although about ten would be considered very active. The Radio Society runs a weekly net on 3.645 MHz every Friday at 1900 UTC. A rough check on Tuesdays at 1730 UTC on the same frequency may reveal a bit of activity as well.

Any ham is welcome to 9J2-land, and it would be helpful to all if you would send a photocopy of your licence well in advance to make arrangements for a possible temporary licence. Send it to me as Secretary of the Radio Society of Zambia at our headquarters and QSL Bureau: PO Box 20332, Kitwe, Zambia.

This year alone we were privileged to see Lloyd and Iris Colvin, W6KG and W6QL, for a short while. Lloyd was given the call 9J2LC, and Iris, 9J2IC. The couple operated mainly from their hotel room in Lusaka using their own equipment.

Soon after, a visit was made by Dilip 5Z4MR, who was issued 9J2DRT. He also qualified for the WZA after contacting ten stations within Zambia. Special callsigns are issued from time to time mainly on application to the licencing authorities.

Only five have 2m rigs and they are scattered about. A lot of interest is shown for 144-MHz operation, but finding equipment is a big hindrance. The five have thought of a repeater or two, but the same problem of equipment is manifested. Any kinds of donation in the form of kits for repeaters and actual 144-MHz rigs which may be obsolete, from other hams, but still in good working order would be a great step. . . . [What have you or your club to give? Let *73* International know about any donations! With photographs if possible.]

Hams are permitted to operate mobile as well. Third-party traffic, however, unfortunately cannot be discussed.

The WZA certificate may be won as follows: 9J2 stations contacted on 7, 14, 21, and 28 MHz count one point; on 10, 18, and 24 MHz, two points; and on 1, 8, and 3.5 MHz, three points. Special prefixes count two points. Same stations contacted again on other bands count again. Zones 36, 37, and 38 need 20 points for the award; all others need 10. The award is available to SWLs; there are separate classes for AM, CW, SSB, and mixed. Send certified copies of logs to Awards Manager with 10 IRCs, 50 pence, or US$1.

Let us hear from you! 73, Daniel. ■

NEVER SAY DIE

from page 62

My recommendation for getting into your own business is to either start at home in a small way and learn so your mistakes won't blow your cash reserves—or learn on someone else's money. Just about every entrepreneur eventually needs help as his business grows, providing you with exactly the learning experience you need—just not at your expense.

If you don't blow your best learning years—from 45–65—when you get into the time of life that larger businesses normally throw you out to die, you'll have your own business and not have to worry about which ham magazine you can afford—or even which rig to get. You'll get the best—and perhaps a spare to take along on trips to Africa the way Lloyd and Iris Colvin do.

Then, when I ask in an editorial who's interested in going down to some obscure Caribbean island with me for a few days of instant DXing, I'll get an enthusiastic letter from you. The fact is I'm writing this editorial while sitting on the beach on Cayman Brac, a tiny island south of Cuba. It's skin diving heaven, so I've been here taking underwater pictures of the beautiful reefs.

Now here's an island which is easy to reach—has very nice hotels and great food—wonderful skin diving—is surprisingly inexpensive. . . what a great spot for a continuing DXpedition! What I have in mind is setting up a first-rate ham station for you to time-share—like a condominium. I haven't priced everything out, but I'll bet we could offer three days of hot DXing, including hotel, food, and transportation, for under $750.

Having done a good deal of DX-peditioning, I can assure you it's an experience you'll never forget. The Caribbean is an ideal spot, too, because it's easy to get to—there are nice hotels (beats the heck out of tents)—licensing is easy—the weather is usually excellent—transportation is convenient—it's close by—and, best of all, the propagation into the U.S. is first rate.

DXing from Lesotho (my call there: 7P8CA), for example, has its drawbacks—like taking a long time to get there—costing a bundle—and then, once you're there and on the air, you don't hear much. Really a great combination.

Speaking of entrepreneurialism, *Insight* magazine had quite an article on the problems American Indians have been having. It seems they, like the blacks, have a culture which does not encourage entrepreneurs, with the result that the Indians are gradually losing everything. They're poor as a group and staying that way.

Our educational system generally supports this lack of prestige for business people. College, in particular, aims at preparing graduates to work in large businesses, for the government, or for teaching. If you think about it, you'll recognize that these are the three best career paths to never make any serious money. College seniors are beseiged by recruiting teams from our large corporations—a kind of feeding frenzy takes place which sweeps most graduates into these virtually dead-end career paths.

A couple times during my life I came close to working for the government. After WWII ended I was teaching electronics at the submarine base in New London. When it came time for my release from involuntary servitude I was anxious to get the hell out. I'd risen to a first-class electronic technician. During the war the Navy had refused to let any of the ETs sign on as regular Navy, so suddenly they found themselves losing the people they needed the most. I was offered a Lt. Commander's rank if I'd stay in and teach. I might have stayed if they'd upped it to Captain. Close call!

Another time, after I'd gotten absolutely fed up with being a television director, I applied for a GS engineering position. By the time they got around to accepting me, better judgment had fortunately taken over. That's when I made my first big entrepreneurial leap, starting a loud-

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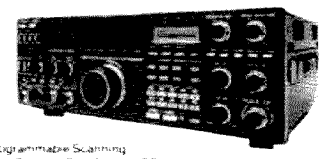
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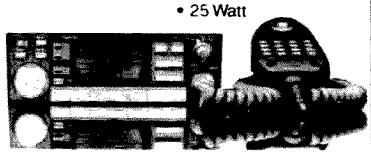
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I'd like to see our colleges include courses to help people become entrepreneurs. Small business is the strength of our country, so it should be encouraged and youngsters should get educations which help them in this direction. I'm no fan of big business. I've got a book written by a VP of GE called *Big Business, a Threat to Democracy*. He makes a very good case.

Big business is driven by quarterly business reports—so we see lobbyists in Washington protecting their interests—a general lack of regard for the environment or people. We see cigarette firms selling their proven killer drug to millions of helpless addicts. I watch with pain as the few nicotine drug addicts who work for me sneak out back of the building for their drug fix every hour.

Life is a gamble. Every day we gamble as we drive or even walk across the street. Yet I see people refusing to go to Europe on vacation because they don't want to gamble on being the target of a terrorist, yet who take a far, far greater gamble by smoking. Talk about rolling with loaded dice! Cigarettes are just as deadly as Russian roulette—it's just a longer game. How soon will it hit is the question. Will it be cancer? Emphysema? A heart attack? Will the cancer be in the throat? Lungs? Intestines? Or will it be a stroke? Will you be hit before you reach 70? The odds are enormous that you will.

So we see big firms throwing every legal obstacle they can in the way of any government regulations which might slow down their polluting and poisoning. The alarms about the damage to our upper atmosphere are being verified—the result has been a stepping up of lobbying to prevent government action, not major efforts to develop chemicals which will not cause this apparently irreversible damage. So we continue to use spray cans—and produce millions of tons of refrigerant a year. The profits in the next quarter are a lot more important than what happens to the world in 50 years. Other than being needed to compete with other huge businesses from other countries, it's difficult to justify most big businesses.

Small business provides more jobs, more wealth for the people, more innovation—and even pays more taxes. Of course small business doesn't offer quite the gambling opportunities we get with large corporations, with their stocks and bonds and our stock exchanges. And without our megabanks, how would Third World leaders ever get the billions for their Swiss accounts?

The compact disc business is growing rapidly. I've been visiting CD-only stores in recent months. Just about every one I've visited has been able to get into the black in three to five months—not bad for opening a new store. Entrepreneurs who keep a weather eye on technology have an edge. I'm in the process of changing my computer store chain into high-tech stores, adding telephones, compact discs, CD players, and a few other high-tech gadgets. If the 8mm video firms decide they're going to make a major effort, we'll add an 8mm department too.

There are opportunities at every turn for the entrepreneur. Every new technology opens opportunities for new products to be designed, manufactured and marketed. A thousand small outfits sprang up with TRS-80 support products a few years ago, with hundreds of them doing very, very well. That was before IBM outsmarted Radio Shack, taking advantage of the incredible Radio Shack blindness to the power of third-party support of their computers. Well, that blindness cost Radio Shack tens of billions—and gave IBM the microcomputer industry as a gift. So, instead of IBM having to put out a TRS-DOS computer, we see Radio Shack resigned to bringing out MS-DOS computers just to survive.

If we can get amateur radio growing again as a hobby and as a market, we'll need hundreds of new ham products—antennas, tuners, amplifiers, packet equipment—things which you might just be able to design and start making. In the meanwhile you might want to see what you can come up with for compact discs, for 8mm video, communications, security, or any of the other new high-tech fields. It can be any product, service—or even information.

You get too soon old and too late smart, as the saying goes—so the sooner you start thinking

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in terms of being independent economically, the better. It's bad enough to work at a job all your life which doesn't allow you to splurge now and then, but then to face retirement with even less...? Imagine, having so little money that you have to pass up subscribing to a ham magazine you enjoy!

The early conditioning we get from our parents is important. My grandfather was an entrepreneur—made millions as an inventor in the 20s. He lost everything in the 1929 stock market crash, but that didn't faze him. He got right back into business again marketing a new type of indestructible brake lining invented by an uncle of his. My father was an entrepreneur—started the first transatlantic airline—so I had the right mind-set to be an entrepreneur. And that's important, as we can see from the black and American Indian experiences, where social priorities are keeping these groups from success.

BEING DISAGREEABLE

The theme at the *73* booth at hamfests for years has been, "I enjoy your editorials, but I don't always agree with 'em." Excuuuse me, but that's a cop out, so let's think this one out.

First, many more bureaucratically inclined readers have a problem with my whole way of writing. I'm amazed at how many words some writers use to communicate their ideas. Being of Yankee lineage, I tend to try to get across my ideas with as few words as possible. Yes, I know my editorials seem to go on endlessly, but—hey—take a closer look and you'll see I've covered a wide range of topics, none in any exhaustive detail.

Readers who are more used to writers who endlessly repeat themselves, rather than using my approach of just presenting almost an outline of the ideas, often have a problem. I've never been paid by the word, so I've never developed the redundancy system of writing to maximize my income with a minimum of ideas.

I'll tell you what. The next time you get the feeling that you're not agreeing 100% with what I'm writing, let's see if you're operating on the basis of my disturbing a belief of yours or if you actually have some data that I don't which might lead me to different conclusions.

Now, if we're having a difference of belief—a religious difference, you might put it—let's remember what my grandmother used to say—a man convinced against his will is of the same opinion still. And on quite a few ham subjects we're as much up against religious fanaticism as are the Moslems vs. the Christians, the Moslems vs. the Jews, the Protestants vs. the Catholics, and so on. Like no-code, for instance, where the born-again agnostics are up against old-timer intransigence. Heh!

So, instead of taking the easy out of just not agreeing with me, let's see if there's really any substance to your disagreement. Let's see if you can articulate your objections. I suspect you'll find as you try to explain yourself that you are operating on some weak premises. You may begin to suspect that if I'd hammered my ideas home over and over again—preaching the sermon, so to speak—you might have agreed with me. Well, I don't. I try to put as much meat into what I write as I can, leaving out the fluff, fat, and overkill.

Now and then I've pinned down readers who claim they don't always agree with me. "Okay, name one thing I've written with which you don't agree." This often flusters people into generalities or sudden memory loss (SML). Instant amnesia. When a specific area of disagreement is cited, I appreciate it because I can then find out if I'm up against a religious conviction or a question of facts. If I am wrong about my facts I sure want to know. What usually happens is that my facts are a lot more solid—or I'm able to bring to light some of the background on why I wrote what I did.

You see, I have a psychological problem. I was brought up in a family where any vague statement was challenged, so I learned early on to do my homework or suffer the embarrassment of Being Wrong! The dictionary was whipped out at the slightest question about a word's meaning or pronunciation. This helped me build a larger than average vocabulary.

So let's bring this business out in the open. The next time you find yourself disagreeing with me about something, is it because

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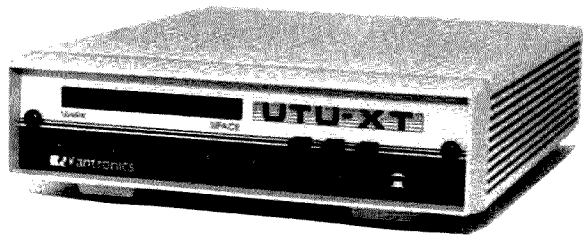
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you have some beliefs which I've disturbed or do you really think I'm working with poor information? If you've got data I don't, let's see what you've got.

I'll be glad when we're able to use our home computers to cross-index magazines and books. I've read around 6,000 books so far, plus perhaps 2,500 magazines a year, but, like everyone else, my retention of details is low. It would be nice to be able to quickly find the reference to a recent *Business Week* article on how much of a loss of income on the average we're going to have because the U.S. is changing to a service and sales economy instead of one based on manufacturing. I remember the general article, but time is gradually erasing the details.

Think how much more valuable magazines (and books) will be when we are able to easily search them with our computer for information. It'll be along, and when it comes I'll be one of the first users.

Speaking. . . no, writing about manufacturing going overseas, the new tax laws should substantially accelerate the movement of manufacturing to Asia—just what we need. This will then tend to reduce our overall income by about 40%. You see, the new tax laws have increased the taxes on business. Now if we weren't up against foreign competition, we could just go the old route and say what the hell and raise prices to pay the increased taxes. But there are fewer and fewer industries where we aren't in price competition with imports, so increased taxes will mean we'll have to move the manufacturing to lower-wage countries if we're going to stay in business. I believe we'll see business fleeing America faster than ever.

Moving taxes from people to business may feel good, but it's pernicious. The Japanese don't tax their businesses, which may help to explain how they are able to be so incredibly competitive, even with the yen increasing in value.

This is going to put pressure on even the small businessman to find an Asian partner in order to keep his costs of manufacturing down. I'll bet I'll be seeing more and more businessmen on the October Asian consumer electronic show tours in the next two or three years.

You say you disagree? Okay . . . let me know where you think I'm wrong. I sure wish I were, but it looks to me as if Congress is at it again, waving in the winds of election fever—a 365-day-a-year plague in Washington.

Let's not play the old "I don't always agree with you" tune. If you're going to be disagreeable, then sit down and send me your facts. Or do I have to start doubling the length of my editorials just to bludgeon you with the details which resulted in my conclusions? Yes, I know everyone is lazy and I'm a damned nuisance when I make you think. Hey, no one is holding your eyelids open and forcing you to read my editorial—that's just self-inflicted torture, so stop being disagreeable about it.

BIG RIG NEEDS HOME

I've got just what you Big-Gun DXers in Southern California will love—a ten-kilowatt sideband rig someone wants to give away for free. Does that make your little heart go pitty-pat?

The rig is a model GPT-10K, made by The Technical Materiel Corporation in Mamaroneck, New York. It's not exactly a brand new rig—manufactured in 1962—but it's a 2–28-MHz rig—imagine the fun you can have on 40m! Hey, no fair taking over WWV's channels, okay? This could make quite a dent on CB also, eh? Talk about real punch!

The rig is located in Southern California (naturally). It's a big mother—six-foot rack—must be near five feet wide—on wheels (whew!).

How to win it: The rig is available to any ham or ham club which can come up with a damned good reason for getting it. You'll have to go and get it—with a truck and some riggers. Write your rationalization for getting this rig on one page and send it to me. My decision (and that of the owner) will be final. No bribes, okay?

This rig, made for the Army, is built like all TMC gear, like a brick outhouse. It's a beaut! I remember their old GPR-90, the best HQ-129 ever built. TMC disappeared from the ham scene about the same time as everyone else, right after the Incentive Licensing disaster hit us. They sure did make fabulous radio equipment.

All that's needed to make this rig legal is a heavy shunt on the final plate meter.■

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ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U. S. S. R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
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PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U. S. S. R.								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
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SOUTH AFRICA										15	15	
U. S. S. R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

Although the forecast for the last week of the month looks good at this time, there is always the possibility of a disturbed geomagnetic field due to unforeseen solar influences. In general, November looks as if it will support good HF propagation to all parts of the world except on the days noted. Note the trends. You may expect poorer conditions centering around the 3rd, the 13th, and the 23rd of the month.

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G–F	3 F	4 F–P	5 P	6 F	7 G	8 G
9 G	10 G–F	11 F	12 F–P	13 P	14 P–F	15 F–G
16 G	17 G	18 G–F	19 F	20 G	21 F	22 P
23 P 30 G	24 F	25 G	26 G	27 G	28 G	29 G

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Issue#315

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This single-chip switched-cap filter goes together in a snap . . . and has skirts so tight that you'll only hear the dits! WA3IAC 48

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Results of the 1986 160- and 75-meter tests, plus rules for 1987's edition. KE7C 50



AEA's PK-232

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NEVER SAY DIE

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D'JA SEE THE *NATIONAL GEOGRAPHIC*?

The October issue of *National Geographic* got me all excited—three new republics about to be formed in the Pacific! In case you're not an *NG* reader, the three new republics which are being made from U.S. trust territories which have been under the auspices of the U.N. are the Republic of Palau (Bilau), the Republic of the Marshall Islands, and the Federated States of Micronesia.

Presumably these three new countries will have to form their own FCCs to regulate communications and issue licenses. Presumably they'll have new call prefixes to go along with their new status. Presumably there will be the usual panic to get these worked and confirmed.

Also being formed is the Commonwealth of the Northern Mariana Islands, but I suspect this will be about as separate a country as Puerto Rico. It'll be the same in country status as before—probably with no call prefix change.

The article in *National Geographic* was vague on just when these trust territories would assume republic status—this hinges on a U.N. confirming vote. The countries have their new flags and are getting ready to be in business.

For the last two years I've been trying to work some time into my schedule to get to some of these islands—to do some DXing—take pictures and skin dive. I had in mind visiting Palau, Truk, Ponape, Majuro, and possibly Yap. It's a long time since I've been to any of those places.

During the war I got to Majuro for a couple of short vacations. Majuro is a large atoll made up of a ring of islands around a beautiful lagoon. Each of the islands had been given a girl's name—the submarine rest camp was on Myrna and the submarine tender there was the *Bushnell*, named after a great-great-grandfather of mine who invented one of the first submarines.

It was in the Majuro lagoon that I did my first skin diving, using a Momsen Lung which I'd converted. I was unable to convince anyone else to even try it. It was also on Majuro that I heard about Amelia Earhart and Fred Noonan crashing in the lagoon on their ill-fated flight to Howland Island—they and their plane were removed by the Japanese, who owned the islands at that time.

The submarine rest camp at Majuro was fine—you couldn't ask for a more beautiful spot with white sand beaches, an incredible lagoon, palm trees, and a perfect climate. We went there twice in 1944 for two-week rests while the tender repaired and updated our boat. Our barracks were in Quonset huts—there were movies every night—followed by gedunks (ice cream). When we arrived, the first order of the day was to get our mail—then our pay. This was followed closely by a flurry of poker games which moved most of the money into the more skillful hands. Those were some of the highest stakes poker games I've ever seen—except in the movies.

I remember when we arrived at Majuro for the second visit. Normally gambling wasn't allowed on the boat, but once we were tied up at Majuro the taboo seemed to be off and a 25¢ limit poker game sprang up in the crew's mess. Being normally a very lucky card player, I sat in. I've never had such a run of bad luck in my life—we played for about four hours and I didn't win one single hand. The only winnings I had were on side bets on who would have the worst hand—I did pretty well with



"Are you the handsome one who advertised for 'Ham Help'?"

Continued on page 10

QRM

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QRX . . .

EDITED BY PERRY DONHAM KW1O

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In Orbit

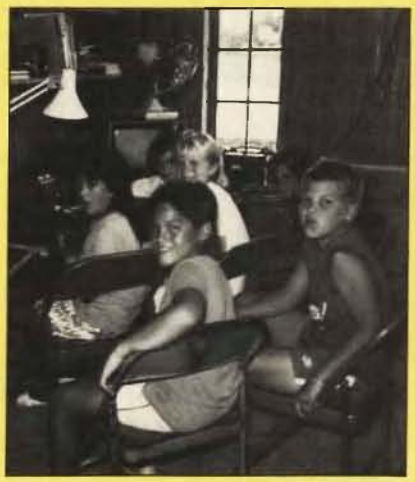
AMATEUR RADIO may soon have a permanent presence in space! Roy Neal K6DUE, Vern Riportella WA2LQQ, Bill Tynan W3XO, Larry Price W4RA, Dave Sumner K1ZZ, and NASA's Dr. Tony England W0ORE met recently to discuss the possibility of including a ham shack on board the U.S. manned space station due to fly in 1995. Three main functions will be stressed in a proposal to be submitted to NASA early next year: recreation, utilization, and education. The station will be used to give astronauts something to do in their spare time during their long months in space, and an "autopilot" mode is planned to allow the equipment to be used as a flying repeater (that way the system could be utilized when the astronauts are not using it, instead of just sitting idle on the shelf). The most exciting aspect of the project is education. One idea is to have a set of roving vans outfitted with communications gear which would periodically visit school classrooms. The students would get a chance to talk one-on-one with the scientists aboard the spacecraft; a one-way fast-scan downlink is also being considered so that the children can also see who they are talking to. The space station program is a result of President Reagan's 1984 directive to place a permanently manned platform in space.

Youngster

THE WESTLINK REPORT has announced the winner of the 1986 Young Ham of the Year competition. **Shawn Alan Wakefield WK5P** received the honor at the Ham/West convention in Las Vegas (thanks to Yaesu for picking up Shawn's air fare and hotel bill). At the banquet, *Westlink* Editor Bill Pasternak WA6ITF cited Shawn's outstanding contributions to the hobby, including the formation of a ham radio Explorer's Post and the creation of a ham club at his high school. Shawn is 16 years old; with a record like his, the future looks bright.

Camp Kudos

THE DAYTON AMATEUR RADIO ASSOCIATION went to camp this summer. **John McCoy NS8A**, backed by DARA, spent six weeks at Camp Kern, a branch of the Dayton YMCA, introducing youngsters to the excitement of ham radio. Equipment was donated by ICOM, Moseley, and Butternut, and a complete HF/VHF/packet station was set up in an old bath house. The original DARA plan was to demonstrate ham radio to the campers, then contact them after the summer to enroll them in classes. John, however, decided to go full bore and encouraged the kids to earn their Novice license in one week! The result? Seven new Novices in the first one-week session, with 13 more licensed in the remaining five sessions. The sixteen boys and four girls ranged in age from nine to fourteen years old. John says that the biggest problem was answering the children's questions ("What's a hernia operation?") and finding interesting people to talk to on the air. It was also a bit difficult, he says, to explain to the kids that they had to learn Morse code . . . especially when the packet station across the room was spewing out error-free data at 1200 baud. Would he do it again? Yes! In fact, next year's plans include expanding the program to two more camps.



Kids at Camp Kern crowd around the operating position.

Rumor Or Fact?

WE MIGHT AS WELL confirm the rumors that have been floating around concerning a new DX award . . . look for an official announcement and rules for *73*'s version of DXCC in the January, 1987, issue! Here are a few tidbits to whet your palate: Nearly 400 countries are on the list (ARRL's DXCC has just over 300); everybody starts at zero on January 1st; there won't be a big headache with card-checking; about twenty special endorsements are available. This award is the one to shoot for!

Is It Art?

THE ARRL is sponsoring a national art contest for students. First, second, and third prizes will be awarded in three age categories (8–12, 13–15, and 16–18), and the winning entries will be sent along to a worldwide competition sponsored by the ITU in Geneva. The theme of the contest is "Youth In Amateur Radio." The judges are looking for original art depicting the student's impression of ham radio in a photograph, drawing, painting, or illustration. Artwork should be no larger than 11 x 14 inches, and must be accompanied by an official entry form. Each entrant must be sponsored by an ARRL member—a list of sponsors and copies of the entry form are available by writing to the ARRL, Department Y, 225 Main Street, Newington CT 06111. The deadline for entries is February 1, 1987.

Stoner Stoned

THE FCC has said "no" to Don Stoner's **Public Digital Radio Service**. Stoner wanted to put a no-code, low-power packet service on a portion of the amateur six-meter band (52–54 MHz). Don's system went to great extremes to avoid interference to television reception, including smart controllers that would automatically reduce the transmitter's power to the minimum level necessary for communication (we need that on 20 meters!). The biggest stumbling block to Don's request is an agreement at WARC-79 that the spectrum from 50 to 54 MHz would be exclusively allocated to hams in Region 2. In dismissing the petition, the commission suggested that another home be found for the PDRS, possibly at 900 MHz. Our 902–928-MHz allocation is not exclusively amateur. I think that the FCC is being very positive about the creation of this new service, and a PDRS should become a reality once the technical details can be worked out.

Exams Examined

NOW THAT the volunteer examiner system has proven itself, the FCC is looking toward getting out of the examination business completely. In a recent Notice of Inquiry (FCC 86-400), the commission proposes handing over commercial radio operator examinations to the private sector. This would save the FCC money and provide more testing opportunities. Comments are being solicited regarding whether handing over commercial testing is a good idea, and if so, how examiners should be picked and funded; send your comments to the FCC, 1919 M Street NW, Washington DC 20554.

Test Tip

IT'S NEARLY TIME for another edition of the popular *73* World SSB Championships, scheduled for January. Now is the time to send off for your official log sheets—drop an SASE in the mail to Bill Gosney KE7C, World Championship Contests, 2665 North Busby Road, Oak Harbor WA 98277. You'll find the results of the 1986 160- and 75-meter contests starting on page 50 of this issue.

House Hams

AN INTERESTING CONCEPT has been put forth by **Jim McNalley** in a working paper released by the FCC's Office of Plans and Policy. Jim suggests that it would be nice to allow members of a household to use ham equipment to communicate with the station licensee when he or she is mobile or portable. In other words, you could chat with your wife on two meters while you were driving home, even if she doesn't have a license. Communications would be identified by the station call. Jim feels that such a modification to amateur radio would increase the value and popularity of the service, and that the ham community could exercise enough discipline to keep the operation clean. This isn't an NPRM or NOI or anything official; it's just someone at the OPP blue-skying. We certainly should give it some thought, though, and we'd like you to drop *73* a note telling us whether or not you think it is a good idea. The address is *73* Magazine, WGE Center, Peterborough NH 03458, Att: OPP.

Culled Calls

HERE'S SOME MORE INFORMATION on the proposal to allow hams to choose their own callsigns. Basically, the FCC has decided that it would be no trouble at all to let an outside organization issue "special" calls. The commission would still issue a callsign to each licensed amateur; you then would have the choice of using that call or applying for a special one. There haven't been any firm proposals submitted yet, but tentative plans have calls costing between $20 and $30. Priority would be given to requests for calls that were lost due to a move into a different area (remember when you had to do that?), and requests for calls of Silent Keys by a family member or memorial station. One hitch in the idea is that the FCC would like to spread the responsibility among several groups (similar to the VEC program). This certainly complicates record keeping—all of the organizations would have to share a data base. Also, the League has indicated that they are interested in issuing callsigns *only* if they have exclusive authority, something that may not be legal under antitrust law.

ECPA Passes

AMIDST A BIT OF CONFUSION, the Senate has passed the Electronic Communications Privacy Act. The ECPA was tacked on to a drug-abuse program bill that passed easily. However, there is some concern about the method used to get the ECPA through Congress—specifically, a report must be issued by the House Judiciary Committee before it can be sent to President Reagan for his signature. The Act is much different from the version first proposed, which sought to make illegal reception of just about every common-carrier radio service. The ECPA passed by the Senate makes legal the reception of cordless telephones, pagers, marine and aeronautical communication, ham, CB, GMRS, government, law enforcement, police, and fire transmissions. About the only thing that it is illegal to listen to is cellular telephones. It's nice to see the Act toned down, but I still think that any restriction on reception of radio signals is a violation of a fundamental right. Is it time for a bit of civil disobedience?

Found, Fined

I KNOW I PROMISED not to mention Herb Schoenbohm KV4FZ for a while, but his name popped up in connection with a recent FCC raid in the Caribbean. Acting on several complaints from hams, engineers from the San Juan field office tracked down **David Ackley W4UWH** on St. Thomas, who was intentionally interfering with a net on 40 meters (doubly bad since David has a Technician-class license). Herb's name comes up because Ackley was retransmitting taped recordings of KV4FZ. W4UWH was fined $1,450 for his violations.

Aloha

THANKS to our friends at *The Westlink Report*, *Amateur Satellite Report*, and *The W5YI Report* for help with this month's QRX. Also, since it's that time of year (again!), best wishes for a safe and happy holiday season.

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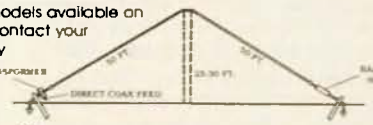
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from page 4

that. So, even with the quarter limit, I found myself out a couple hundred dollars—a month's pay. I went to the next table where a crap game was going and won it all back (and more) in about two minutes.

You can tell me all you want about there not being any luck in gambling—it's statistically impossible to lose for four hours. No, no one was cheating.

Another sport at Majuro was making Gilly. When our crew went ashore they took along the coffee urn, complete with the special insides made by our machinists so it would distill torpedo (denatured) alcohol into a slightly less deadly fluid we called Gilly, which was mixed with canned grapefruit juice. Soon we had drunken sailors staggering around throwing huge chunks of coral on the tin Quonset hut roofs, yelling "depth charge!"

It'd be fun to get back and see Majuro again. I'm sure nothing is left of the rest camp on Myrna, just as there wasn't a sign of Camp Dealey on Guam—only a gas station with the name.

I'd enjoy visiting Palau and Yap, too. The last time I was there we had to stay about a mile offshore in our submarine. We did lifeguard duty at Yap when Navy aircraft raided it. We chugged around on the surface watching for any downed American planes. The Japanese planes, frustrated by the number of American planes attacking Yap, left them alone and took their frustration out on us, a safer target. They strafed us and then bombed us, forcing us to dive. One bullet hit the hull right above my head where I was sitting in the crew's mess just before we dove.

We spent a good deal of time circling Palau, so I'd like to get there and see what I missed 42 years ago. I don't know just what it'll cost to visit these islands, but I'm sure it won't be very expensive. Are there any of you who have some time and can afford a short island-hopping trip like that with me? It'd be a lot more fun with two or three fellow hams than alone. It'd be a trip you'd never forget.

Micronesian Airlines gets to all these islands, so it's not difficult to get around. Most of 'em have at least a small hotel, so there's a place to stay. I'll bet we can find some local hams who will be delighted to help make our visit fun. Heck, we might not even have to carry hundreds of pounds of ham gear and take the time and work to get it all set up.

Amateurs in rare spots are always delighted when someone comes in and works the pileups for them—as long as they handle the QSLs too and don't cause the local hams the trouble and expense of cleaning up after 'em with QSL cards. Many hams in rare spots do all they can to avoid the QSL chores brought on by the thousands of hams who have no interest in them personally, but just want a new country confirmation. It's a royal pain in the ass for most hams in rare spots.

QSL managers help some, but that doesn't get you out of pileups and breakers frantic to get your card. It's almost impossible to have a normal contact with anyone, a factor which often drives operators in rare countries off the air entirely. Imagine if all you could ever make were contest type contacts! Imagine if every time you tried to actually talk with someone you got breakers who were increasingly nasty about getting a contact before the band conditions changed. Is it any wonder ops in rare countries get fed up in short order? Perhaps you can understand why ops in rare spots are so anxious to have visitors come in and work the bands to take off some of the heat.

Of course, as DXers know, the heat doesn't stay off for long. We seem to be able to generate more DXers spontaneously, so no matter how worked out a rare country may be, a few months later there are pileups again.

Until you've worked the business end of the pileups you don't really get the excitement of amateur radio. Sure, it gets old after a while, as does almost any excitement, but for the short run there's little in amateur radio to compare with the kick of operating from some really wanted country. Heady stuff.

My first experience with this was back in 1958 when six of us went to Navassa Island and put KC4AF on the air. We operated around the clock for a few days and had the time of our lives. Half of the chaps on the trip smoked, so they're no longer alive. Navassa was a tiny, uninhabited island off the coast of Haiti—belonged to the U.S., hence the KC4 call.

We all drove to Miami, took our rigs, generators, antennas and towers on a cargo ship to Nassau in the Bahamas, where we hired a motor-sailer ship which took us down to Navassa. It was one hell of a trip down, with us going through the edges of a hurricane. Navassa has no beaches—the only way you can get on the island is by climbing up the sheer cliff using a hanging ladder put there for occasional Coast Guard visits. It's a trip of a lifetime.

One trip to Navassa is enough for even the most dedicated DXpedition fanatic—it's one of the tougher places to get to in the world. Naturally, I went there again in 1973 with another group



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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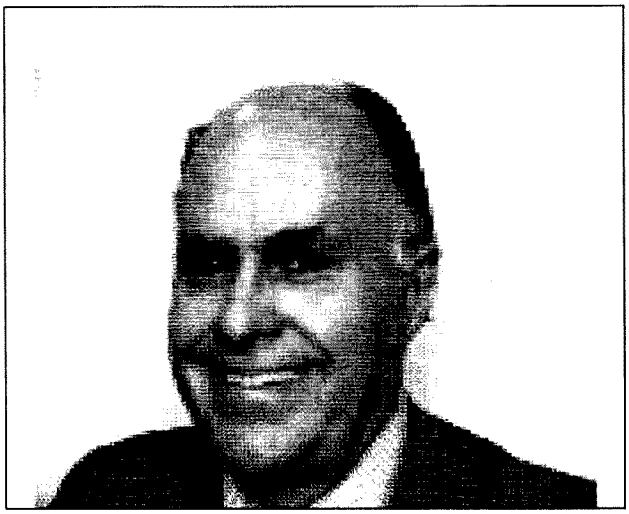
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and operated as KC4DX. I'm a sucker for adventure.

Operating from the new Pacific republics won't be quite as adventurous as Navassa, but I know the pileups will be record breaking. If you don't know how to handle 'em when you go there, you'll be an expert when you get back. Perhaps I should give some lessons. I've operated from a lot of rare spots—let's see, some of the rarer places I've activated were Kenya, Lebanon, Syria, Iran, India, Nepal, New Caledonia, Fiji, Wake Island, Philippines, Sabah, Sarawak, Western Samoa, American Samoa, Tahiti, Jordan, Thailand, South Korea, Swaziland, and Lesotho.

If there are some of you readers interested in visiting the new republics and putting them on the air for a while, let me know and I'll start putting together a DXpedition. Of course, I suppose some group will want to grab "the glory" and go there first. How glory has any real meaning in the small world of amateur radio, I'm not sure. To me it's the fun of going there and working the pileups. I really don't care if I'm first or fifth, so if there are some fanatics to whom this is really important—



Would you buy a used Wouff-Hong from this man?

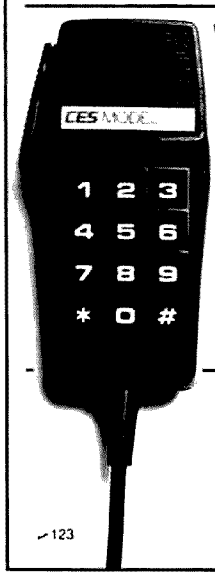
first I suggest investing in a psychological evaluation of your sanity. . . which I know you will fail. There's no glory in amateur radio, just fun to be had.

The hams who sit around anxiously waiting for emergencies so they will have a crack at becoming famous by winning an award for their emergency work have things all out of balance. We should set up to handle emergencies because we enjoy doing it. We should work DX because we enjoy it—and not be willing to kill in order to move up one line in a listing in *QST*. St. Peter does not read *QST*—I hope that doesn't shatter your whole world. I'd even suggest that God doesn't read *QST*, but I know a lot of DXers who place *QST* way above the Bible wouldn't believe me.

So, are you going to face up to your responsibilities as a ham? Are you going to stop taking all the time and start giving for a change? Isn't it time you started making amateur radio more fun for others instead of making so many other DXers miserable with your incessant breaking in and calling in pileups? You know as well as I that you are illegal when you're doing that. You know it's against the LAW to intentionally interfere with other radio signals—and that is precisely what you are doing in a pileup. Don't you try and weasel with that wide-eyed innocence of yours telling me you didn't know anyone else was on the frequency. You did so know and you maliciously stomped all of 'em. That's deliberate and malicious interference.

You say you haven't the time for a trip? Hogwash! Of course you have. You have the time to do anything you really want to. If you've gotten yourself tied to a job where you can't get away now and then when you want, you should start thinking in terms of going into business for yourself. Hey, you only get one run through this life—and the years are going by faster and faster. If you don't get horsed around to where you can get away

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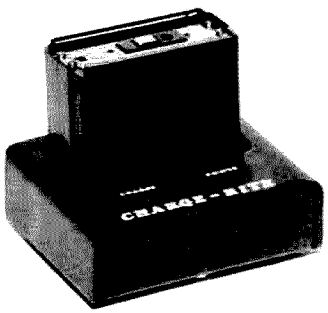
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171

for a week or two to get to Palau or some place with me, it's time to start getting your . . . er . . . stuff together.

I guarantee you don't know many people (any, actually) who are busier than me. Yet I can get away when I make up my mind to do it. I manage to go on the two-week Asian electronic show tour every October. I get away for a few days of skiing every January (and you're welcome to join me if you've got an HT and the time). I get away for a skin diving trip in the summer. I also have been getting to a lot of hamfests and conventions—and still I've managed to run my businesses—perhaps not as well as I could if I didn't do anything else, but the trade-off is fine.

I tried to get you to come with me this October on a DXpedition to Korea, Taiwan, Hong Kong, Sabah, Brunei, and Sarawak. After writing about it for months I had maybe a half dozen hams who felt they could afford the time and money for the trip—not enough to make it feasible. That's pitiful. I should have had a hundred or more queued up wanting to go. I guarantee you that if I proposed anything like that in Japan I'd have a hundred—probably more like 500—anxious to go.

We're not going to get amateur radio back to life and fun unless we're all having fun. Right now the hobby is dying—which is no news flash. There are a number of things you can do to help—as I've written—like get on the air and work Novices—make hamming fun for them by giving them some entertaining contacts. Getting your ham club to sponsor a school radio club in your community is another big winner. Getting on the air and making life fun for other hams with your cheerful personality isn't going to hurt either. Let everyone know you're enjoying amateur radio.

Working DX is a whole lot of fun, so get yourself into gear—get out of your damned rut and hie off to some rare spot and generate some pileups to whip down. Take along packet gear, slow scan, and RTTY—make it even more exciting for these ops.

Now, are we going to the Pacific and have a ball or are you going to just sit there and grumble?

PICTURE THIS!

If you're looking for a way to get into business on the semi-cheap, I ran across a nice scam—making computer printout photos. It's not a new dodge, but this is the first system I've seen which spurts out full-color pictures (see my photo, page 12). They've had black and whites for around ten years now.

The first computer photo printing systems were quite expensive, requiring a minicomputer for power. They did a land office business. Then it got so you could do the same work with a microcomputer at a fraction of the investment, so systems proliferated, killing the market.

"There are hundreds of hams whose perspective is so incredibly distorted that they actually believe it makes a difference whether they've worked 320 or 321 countries."

Around three or four years ago I remember Tuft's Electronics using an Apple II at Dayton to print stuff on hats—that's where the hat you've seen me wearing on the cover and in subscription ads was made. They did T-shirts with the same system.

It's possible this business can be revived with color pictures. Like the black and white printouts, these can be imprinted on T-shirts . . . or whatever. It's too bad we don't use handkerchiefs any more—you could send one with your picture on it to your friends so they could wipe their nose on you. Maybe there's a market for photo toilet paper? I'll bet I could sell tons of Kaddafi's pictures this way. And never mind what picture would sell best at ARRL HQ.

At any rate, if you live where you think you might be able to keep something like this going—in a busy mall—at exhibitions—hamfests—the whole outfit costs about $15,000. That includes the Apple II, disk drive, color monitor, video camera, photoflash and parasol, color printer, control unit, and heated shirt press.

If business gets out of hand, the system is expandable to two printers, a tape storage system for the freeze-frame pictures, and so on.

This looks like a nice spare-time business. The operating expenses are minimal, so mostly you have to make enough to pay for your hardware investment. If you put $3,000 down and borrow $12,000 from the bank at 10% you've got an overhead of around $600 a month for two years to pay off the works. Thus, if you clear $3 per picture, including your time, you've got to sell about 200 pictures a month to break even. If you only work 20 evenings a month the first ten pictures a day will pay off the system . . . the rest is gravy.

Whoa! I'm not suggesting you rush out and buy a computerized color printing outfit and make a bundle, though that isn't a bad idea. I'm more pointing out that there are a thousand ways to make money if you keep your eyes open for 'em. Keep your imagination honed. I spotted this system at the Consumer Electronic Show in Chicago in June. Maybe, if it isn't too tough a trip for you, it would be worth your while to get to the next one in Las Vegas, January 8–11.

Right after CES I usually stop off in Colorado for a few days of skiing with a group of ham industry people . . . if you've got an HT and would like to, join us the 13–18. This January ham industry conference has been going on for over ten years now.

If you'd like more information on the computer color printing stuff, drop me a line and I'll point you in the right direction.

COUNTRY HEAVEN IN '87

One of the biggest beefs I get about the ARRL has to do with their autocratic decisions on what is or what is not a country for their DXCC award. I'm afraid I have a problem with getting uptight over this obviously major difficulty.

Yes, I know, there are hundreds of hams whose perspective is so incredibly distorted that they actually believe it makes a difference whether they've worked 320 or 321 countries. I've known fanatic DXers to spend a thousand dollars in order to make sure they could keep up with their brethern on the Honor Roll when they get a new one.

Indeed, one of the brighter DXpeditioners charged whatever the market would bear to provide contacts for the top guns on the Honor Roll. He bragged he was making over $50,000 a year—with no taxes since it was all in "donations" and there was no way for the IRS to find out how much he was making.

I remember when he signed a call of a brand new country—Spratly Island, as I recall—where he purposely couldn't hear the top guns who hadn't paid his demands, thereby shuffling the top end of the Honor Roll and generating enormous consternation. Some DXers called him solid for a week, 24-hours a day, without connecting. Later investigations seemed to put him as actually operating from northern Thailand, but the League accepted the Spratly QSLs anyway.

His best DXpedition was from Heard Island in the South Indian Ocean. It appears as if he actually operated this one from just north of Vancouver.

Hmmm, I digress—wonder how that happened? Oh, I was making a point about the cosmic uselessness of getting emotionally involved with DXCC and other such awards. If they're fun—fine. If you start finding you are hooked—are staying home from work to get a new country or some such nonsense, hey . . . this is a hobby! Fun, not desperation, is the name of the game.

Now, in order to make things even more fun, I've decided to solve once and for all the problem of deciding what is or what is not a country. I've figured out how to make this a non-problem. How would you like a country award where there are 396 countries? I'm not talking about my deciding what is or what is not a country—not even establishing a DX Country Committee with an Awards Chairman to flog. I'm talking 396 actual legitimate countries for you to chase.

It's this way. First we start with the 320 or so the ARRL accepts . . . and no rude remarks about them being tight-assed about accepting new countries. That's a fine start, but it leaves out a lot of countries which other International Amateur Radio Union (IARU) national amateur radio societies accept. I don't see why the League should have all the votes in the IARU on country counts.

So I set our Perry Donham KW1O loose on getting lists of accepted countries from all of the IARU member societies. These are all national amateur radio societies, so presumably each has the intelligence and the resources to know about such things. When we looked into it we found that the REF (France) had some territories which they accepted as countries,

Continued on page 78

LETTERS

Number 16 on your Feedback card

HAVE A NICE DAY

I must respond to the "Thumbs Down" letter by "Name withheld" in the October, 1986, issue. As soon as I read it, it hit me that people like this guy are a big reason that I am not a ham.

For the last 20 years I have been listening to the ham bands on my shortwave radio. When I was younger I found it very interesting to listen in on two old-timers talking about the good old days. Now that I am older I can go sit in any bar and listen to old-timers talking about how great it was to buy gas for 15¢ a gallon (they forget that they made $2 a day at the time).

In the last five years I have noticed that ham conversations are more like this:

Ham 1: "Gotta go, I'm at work now."

Ham 2: "Yea, Ham 1, you get to work so you can pay Social Security so I can get my check."

Ham 3: "Yep, we've got to get our check."

Ham 4: "73, Ham 1, I've got to scrub my dentures and then go to the doctor again for my bad back."

Then I read this letter in your magazine from some old coot who calls himself a dumb bastard. He says, "Do you really think a Novice or pre-Novice could understand one single word?"

This guy is obviously in the denture crowd. I have friends I have been trying to talk into getting their ham ticket for years. Almost every time I bring up the subject of ham radio, these people don't want to know anything about it or they ask, "Is that like CB?" They ask why you should talk around the world on a noisy radio when a phone call will get through every time. Good question. Why would you?

Nobody wants to learn the Morse code; my computer friends laugh when I suggest it. Do the hams out there really think anybody wants to build crystal radio sets and sit around drinking coffee all day, waiting for some guy to come on from DX-land?

People have money to spend; not everyone is on a fixed income like you hams. This is what people outside ham radio are planning: We are going to take away your bands. Not just 220, but any band we want. We are going to use the ham bands mainly for computer use and for personal communications. Who is going to stop us? Certainly not a lot of fat old farts with high blood pressure who still think that there is such a thing as a pre-Novice, implying that you don't know anything about electronics if you're not a ham.

What's to stop me from buying a radio and transmitting with my computer right now? I can say with confidence that 99% of you hams pose no threat to us non-hams who ARE going to take away your bands and put them to good use. We will let you bitch and moan about your problems over the CB.

You hams are a disgrace to the human race. I have gone to many hamfests around the state and can honestly say that I have never seen a bunch of bigger slobs anywhere. Most of you are fat, smoke cigarettes, use no deodorant, and are just a plain bunch of nerds.

I am also into motorcycles; at swap meets for bikes we have fun. There are lots of good-looking women into bikes. How many foxes were at your last hamfest?

We non-hams are not going to sit back and watch a bunch of fat old nerds sit back and hide from life in their radio rooms much longer. We were willing to give the no-code license a try, but now that's out and we're mad and tired of waiting around for you guys to die off.

We have the money, the vast numbers of people, our health, and energy to devote to the cause of using the airwaves for the public good.

This is America, where the majority rules! Hams are old news and have stayed on the air too long, cluttering up useful frequency space that can and will be put to good use.

Mad in Madison WI

If you're going to hamfests solely to pick up "foxes," you're definitely going to be disappointed. Try a personal ad: "Healthy, prosperous SWM with lots of energy seeks fox for public good." That will take care of your fox problem.

Why don't you pick a callsign and get on the air as a pirate. It's no big deal—quite a few folks I know started their ham career with a bogus call (including W2NSD). I used to bootleg as K9TNV very successfully, except for the time I ended up in the Canadian phone band. You can have great fun if you choose a call from a rare DX spot and run about 5 Watts into a dipole. You could even have some QSL cards printed up (see our ad on page 65).

It's obvious that ham radio scares you—otherwise you'd be on the air instead of writing juvenile letters like this one. Or maybe it's hams that scare you—are you afraid that if you're found out they'll make you stop bathing? Be sure to write when you get your computer hooked up. . . —KW1O.

LANGUAGE BARRIER

With regard to KW1O's response to the criticism of the August packet issue ("Trust me, they understand every word"): I was recently showing my packet station to a young man who now runs a telephone BBS. He seemed to understand 1200 baud, checksum, RS-232 interface, and serial port and appeared interested in learning more about packet. So I let him make a connection on packet. The ham on the other end started using terms like "FB OM" and "What is UR QTH TX FR QSO 73 CUL." My young friend was now totally confused and asked, "Why don't hams speak English?"

Earl Morris N8ERO
Midland MI

I've often asked that question myself! Using CW abbreviations on RTTY and packet is the mark of a poor operator. The crazy thing is that it ends up taking longer to get a message across; by the time you've figured out what the abbreviation is and found the letters on the keyboard, you could've typed the whole word in.

Q signals I can tolerate, since they have become words in our vocabulary (yes, you can use them on phone, too). But if I hear you using "MX ES HNY!" on packet when you mean "Merry Christmas and Happy New Year," I will personally come and stick a pin in your coax.

You should, however, continue to use "73" whenever possible during your conversations. —KW1O.

MUSEUM OR MORGUE?

I'm certain that you didn't miss the editorials in *CO* and *Ham Radio* blasting the ARRL about their "monument to the past." The League is spending several million dollars on it, plus diverting manpower to a project that is ludicrous in the light of a decreasing ham population.

Maybe the ARRL does see the handwriting on the wall and wants to get the project completed before amateur radio dies and it can be buried in a mausoleum. Frankly, I had expected to see about six pages in Never Say Die on this subject, but I guess you have selected a more appropriate time for an exclusive issue.

Your August issue on packet was the best yet—and I feel there is a need to devote more space to packet projects. Amateurs are buying TNCs fast and furious and they are generating lots of questions on operation that are not answered in NK6K's column.

Until I move back to New Hampshire—keep fighting.

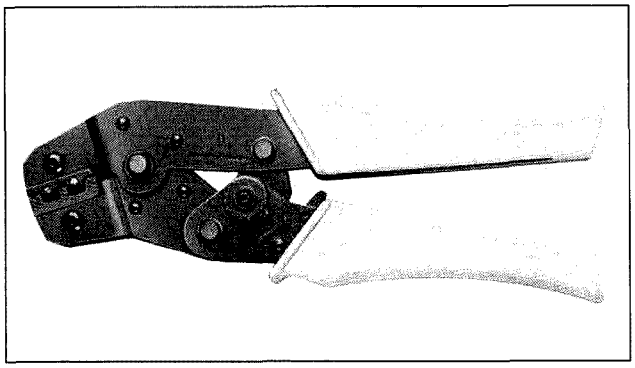
John J. Mitchell W1GSM
South Bend IN

Quoting from "Throw Yourself Into The Volcano" in November's Never Say Die: "I'll bet you thought I was going to be critical of the League for putting so much into a museum instead of investing it in promoting the growth of the hobby. Nope, not me. I think they see amateur radio about to crash in the near future, so the best possible investment will be a museum so later generations will be able to know there once was something called amateur radio. Good move. I've got some first-class stuff I might donate. . . been wondering what to do with it." —Eds.

Nice idea, lousy timing. You have to wonder what's going on at Board meetings; do they even consider what the implications of their actions are? Or do the Directors just vote for something because it sounds neat, or because their friend is backing it? It certainly seems that way this time. Perhaps there should be a mandatory cooling-off period, say 30 days, between the introduction of a proposal and the vote on it. That should be plenty of time for the Directors to come up with an original thought or two. . . —KW1O.

NEW PRODUCTS

Number 19 on your Feedback card



Xcelite's one-handed crimping tool.

XCELITE CRIMPER

Crimping tools designed for one-handed operation are available from the Xcelite division of the Cooper Group. The force needed for crimping is 36 pounds, compared to the 70 pounds required in most other tools. The crimpers are made of high-quality steel and they have been life tested to 50,000 operations. The tools feature a ratchet which guarantees consistent crimping force and a one-finger release mechanism.

For more information, please check Reader Service number 201.

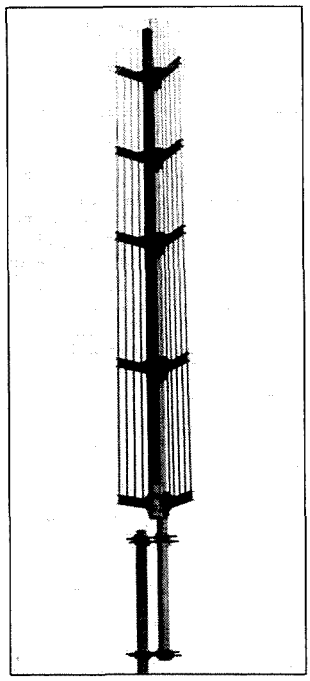
ESP MODEM PROTECTION

Electronic Specialists has added modem protection to their Kleen Line series of transient suppressors. The PDS-11 uses gas discharge tubes to suppress telephone line spikes caused by lightning, electrical noise, or central switching systems. An isolated ground is provided to protect equipment even further. The PDS-11 is set up for a standard 4-pin modular telephone connector; suppression is on the red and green line, with the yellow and black line run straight through.

For complete details on the Kleen Line series, please check Reader Service number 202.

CELLULAR SECTOR ANTENNAS

Two new 800-MHz 60° sector antennas designed for both wireline and non-wireline systems are now available from Antenna Specialists. The 17-dB gain antennas provide a 55-MHz bandwidth, allowing full duplex operation in sector-to-sector cell sites. The antennas are ruggedly constructed with extensive welding of connections to minimize noise and provide maximum reliability. Rated at 500 Watts, the antennas exhibit a 25-dB front-to-back ratio with a vertical beamwidth of 7.5°. Model ASPE963 covers 825–880 MHz, and model ASPF963 covers 835–890 MHz.

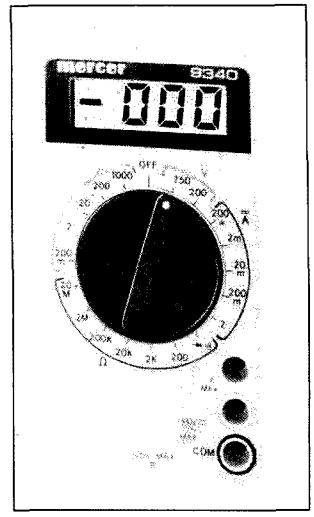


Antenna Specialists' ASPE963 800-MHz antenna.

For detailed specifications, check Reader Service number 203.

MERCER MINI DMM

Mercer Electronics, a division of Simpson Electric, has announced a pocket digital multimeter that weighs less than half a pound. The model 9340 ($44) is housed in a high-impact, high-visibility yellow case and measures up to 1,000 V dc (five ranges), 750 V ac (two ranges), 20 megohms (six ranges), and 2 Amps dc (five ranges). An audible continuity checker and a diode-test position are also included. The 9340 comes with a 9-V battery, color-coded test leads, and an operator's manual.



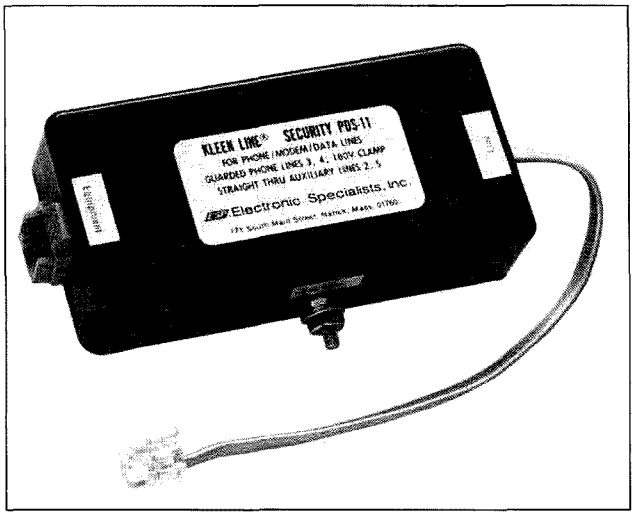
Mercer's model 9340 pocket DMM.

For more information about the model 9340 pocket DMM, check Reader Service number 210.

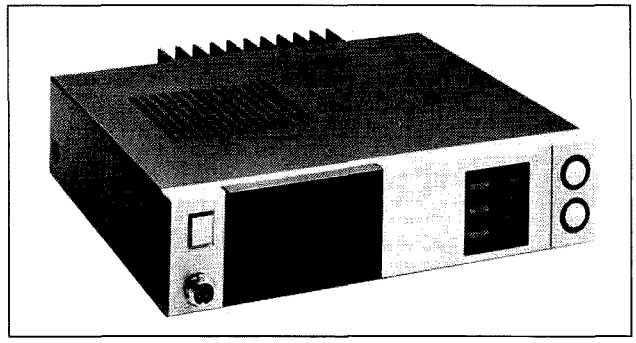
STANDARD RP70K

Standard Communications is now marketing an 800-MHz version of their RP70 desktop repeater/base station. The RP70K features full-duplex operation in either base station or repeater mode with power output adjustable from 5 to 15 Watts. Up to two CTCSS encoder/decoders may be added as options, providing the user with two private channels. Other features include a time-out timer, phone patch capability, and a backup 13.8-V-dc battery with automatic power-failure switch-over.

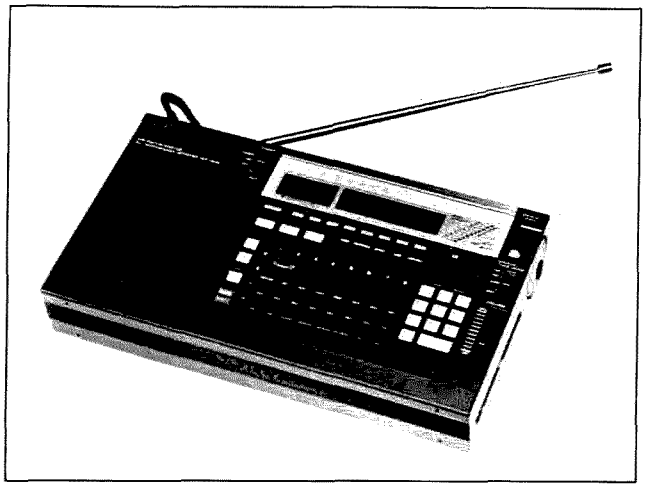
For more information, please check Reader Service number 205.



Kleen Line modem protection from ESP.



Standard's RP70K base station/repeater.



Sony's ICF-2010 general-coverage receiver.

SONY ICF-2010

Sony's feature-packed ICF-2010 PLL synthesized receiver includes dual PLL quartz frequency synthesis, synchronous detection circuitry, a switchable i-f bandwidth, 32 memories with memory scanning, automatic scan tuning, direct keyboard entry, and a built-in quartz clock with a timer. The ICF-2010 covers 150 kHz to 29.999 MHz (AM), 76–108 MHz (FM), and 116–136 MHz (air band).

For complete details, check Reader Service number 206.

TRIO CODE-PRO

PC Code-Pro and Mac Code-Pro are two new products available from Trio Technology. The programs help you to learn Morse code or improve your code proficiency. Code is sent in continuous or five-character random groups from 5 to 40 wpm with selectable character spacing. PC Code-Pro runs on any IBM PC-compatible, and Mac Code-Pro is the Macintosh version.

For more details, please check Reader Service number 204.

SAMS HAM SOFTWARE

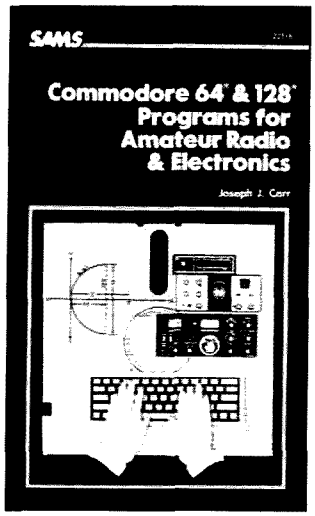
Howard Sams books has published *Commodore 64® & 128® Programs for Amateur Radio & Electronics* by Joseph Carr. The book includes 42 programs covering antenna calculations, swr, transmission lines, impedance-matching networks, dish antennas, capacitors, resistors, and inductors in series and parallel, RLC networks, and operational amplifier circuits. A diskette is available from the author for those who don't want to type it all in.

For more details, please check Reader Service number 211.

COMMUNICATIONS SATELLITES

The expanded second edition of *Communications Satellites* is now available from Grove Enterprises. Chapters cover spy and surveillance satellites, U.S. and Soviet manned space missions, military tactical and scientific satellites, oceanographic and weather orbiters, deep space probes, navigational and communication satellites, and private and direct broadcast satellites. Also covered are international satellites, band plans, transponder identification, and a history of satellite development.

For more information on this new edition, check Reader Service number 209.



Commodore programs from Sams.



The QSYer from Stone Mountain Engineering.

FT-757GX QSYer

Stone Mountain Engineering has announced the 757 QSYer, an accessory for the Yaesu FT-757GX which allows direct keypad entry of frequencies anywhere in the transceiver's range. The QSYer is a tiny computer terminal that interfaces directly with the 757's rear-panel data port; the QSYer draws power from the 757's accessory jack.

For more information, please check Reader Service number 208.

WORLDWIDE AIR TRAFFIC GUIDE

Cambridge Airadio has introduced a directory of HF air traffic control frequencies in the 2–22-MHz range. Cross-referenced lists include over 200 cities worldwide plus weather and airline company channels.

For more information, check Reader Service number 212.

COMMANDER II VHF AMP

The Commander II VHF amplifier from CCIE Manufacturing uses a 3CX800A7 for 650 Watts out with only 15 Watts of drive. Stripline circuits are employed on the input for maximum efficiency. The amp comes with a 155/240-V-ac power supply and weighs only 55 pounds. Precision ball drives with a 6:1 turn ratio are used on all tuning controls.

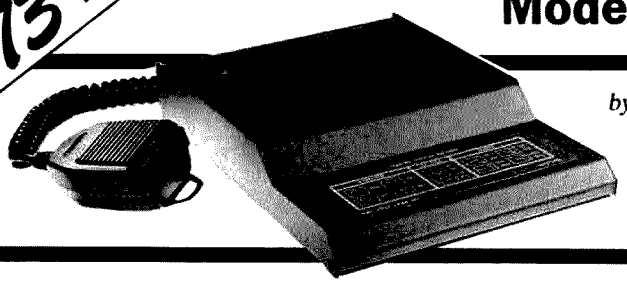
For complete details, check Reader Service number 207.



The Commander II VHF amp.

73 Review

Digital Voice Keyer Model DVK-100



by Jeff DeTray WB8BTH

Nel-Tech Labs, Inc.
28 Devonshire Lane
Londonderry NH 03053
Price class: $349

Number 9 on your Feedback card

It's the 40th hour of the *CQ* World Wide Phone DX Contest. By the best estimate, you've already called "CQ Contest" at least 5,000 times (no kidding!). And since the log already shows 1,000 contacts, chalk up another 1,000 deliveries of the contest exchange, "five-nine, oh-five." Frankly, the ol' voice has just about had it, but there are still 8 HOURS to go! As your attention begins to wander, it wanders to the phone contester's eternal favorite fantasy: When will someone invent a device that does for phone contesting what the memory keyer does for CW? Tape loops are fine, but contesters want the real thing, a true voice keyer. Enter the Nel-Tech Labs DVK-100.

Voice Keyer Basics

The DVK-100 is a Digital Voice Keyer. It records and plays back spoken messages in much the same way that a CW memory keyer handles messages in Morse code.

Messages are recorded or changed by putting the DVK-100 into the record mode, selecting a message number, and speaking the new message into the station microphone. The keyer records the message in the speaker's own voice by digitizing and storing it in random access memory (RAM) inside the keyer. Since the stored message is a digitized representation of the speaker's own voice, it is, when played back, nearly indistinguishable from the original.

Features

With the DVK-100, you can record four different voice messages, then replay any of the four at the touch of a button. While recording, the keyer samples the speaker's voice 32,000 times per second and stores a digital representation of each sample in RAM. All those samples eat up memory in a hurry, and it takes 128K of RAM to store 32 seconds of speech, divided among four messages. Frequency response of the DVK-100 is 300 to 3,000 Hz.

The maximum length of the four messages varies. There is one 16-second message, one of eight seconds duration, and a pair of four-second shorties. These seemingly brief messages are plenty long enough for most contest purposes. For instance, four seconds is about right for recording a contest exchange, such as the aforementioned "five-nine, oh-five," a couple of times. Your callsign will probably fit twice in four seconds, producing a message that is useful when trying to break a pileup. A short, contest-style CQ fits nicely in the eight-second slot, while the 16-second message is appropriate for long CQs, the kind you might use when contest rates are low and shorter calls are ineffective.

The microphone audio passes through the DVK-100 circuitry at all times. This means you can record while transmitting, then immediately play back what you've just said. It also means that if the keyer is turned off, the mike becomes inoperative. The keyer works equally well with dynamic and electret microphones.

Built into the DVK-100 is an audio compressor designed to increase the average audio level going to the transceiver. The processor may be selected at any time for compressing "live" audio from the microphone. To use the processor for recorded messages, it must be selected at the time the message is recorded. If you record a message without compression and decide later you want compression on that message, it must be re-recorded (a 30-second job). Since recording is so easy, you'll want to experiment.

For those of you who want to play astronaut, you can select a NASA-like "beep" to be inserted at the end of each recorded message. I'm not enamored with end-of-transmission beeps, and this one, at 0.25 seconds duration, is too long anyway.

Nuts and Bolts

The DVK-100 is a compact unit housed in a metal enclosure measuring 1.65" high, 7" wide, and 10.6" deep. Control of the keyer is by way of a 10-key membrane keyboard. In addition to four message keys with associated LED indicators, there are keys and LEDs for play/record, operate/program, hi/lo monitor level, plus on/off controls for the speech compressor, monitor speaker (user supplied), and end-of-transmission tone.

The rear panel features five-pin DIN sockets for connecting the DVK-100 to the station mike and transceiver. Jacks for power (10 V ac supplied by a wall-plug transformer) and for an 8-Ohm monitor speaker are also provided. Since the microphone push-to-talk (PTT) line is controlled by the DVK-100, a switch is provided to select either positive or negative PTT keying. The keyer works fine with VOX as well. Finally, Nel-Tech includes an adjustment to match the audio output level of the keyer to the requirements of your transceiver. DIN plugs are supplied to match the sockets on the keyer, but you are responsible for wiring up a short cable to connect the DVK-100 to your rig and for putting one of the DIN plugs on your microphone. The manual gives wiring instructions for most popular transceivers. Nel-Tech plans to offer cables already assembled as well.

As is so often the case with electronic products today, the manual that accompanies the DVK-100 is disappointing. For instance, it contains no discussion about such basic topics as setting the output level of the keyer or how to use the built-in audio compressor to maximum advantage in conjunction with your rig's speech processor. No schematic is supplied, either. While Nel-Tech should not be required to reveal all its secrets, buyers of accessories in this price range have every right to expect more complete documentation. Aside from the interconnection information, the manual really doesn't have much to offer.

On the Air

It works! That's the bottom line. In evaluating the DVK-100, I conducted numerous 15- and 20-meter QSOs in which I asked unsuspecting hams to help me with a "microphone test." My victims were asked to listen to three transmissions and to pick the one that sounded different from the other two. I then spoke the same short message three times, one of which was the DVK-100 doing the talking.

Approximately 25% of the listeners could detect no difference in the three transmissions. Some even apologized for their inability to say which "microphone" sounded better than the others. Of those who heard a difference, about half picked the recorded message as the one that was different. Nearly all listeners said the differences were barely discernible. The quieter the band, the more likely the recorded version would be identified.

First use of the DVK-100 during the heat of battle was in the 1986 WAE Phone Contest. I used the keyer to call CQ, break pileups, and even to give my exchange. While you won't find WB8BTH listed among the contest winners (little items like antennas and amplifiers are still necessary), the DVK-100 definitely pulled its weight. The prospect of a 48-hour phone contest no longer seems as daunting.

Conclusions

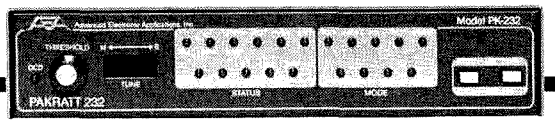
The DVK-100 represents good value. In its intended market of phone contesters, it is currently the only game in town. At present, its applications beyond the contest and DX communities are few, but you can be sure some creative hams will devise new uses for the unit. How about a poor man's voice-messaging system for repeaters? It would certainly be less expensive than existing alternatives.

For phone contesters, the DVK-100 is the solution to a long-standing problem. To arrive at the end of a long phone contest far less fatigued and with one's voice still intact is reason enough for many serious contesters to acquire the Digital Voice Keyer. The keyer works just as you would expect, given experience with CW keyers, and installation requires only wiring up a couple of connectors. I liked the DVK-100. It's a winner. Reader Service number 213.■

AEA PK-232 PAKRATT

by Perry Donham KW1O

Advanced Electronic Applications, Inc.
PO Box C-2160
Lynnwood WA 98036
Price class: $320



Number 10 on your Feedback card

Two years ago, when AEA came out with the PK-64 PAKRATT™ for the Commodore computer, many of us began to wonder when we'd see a PAKRATT for a generic machine. I think there was quite a bit of envy, too, as the non-C-64 owners saw how much fun it was to have a complete station controller run from the keyboard. Finally, there's some relief. AEA's PK-232 is designed to interface with any computer having an RS-232 port. And, maybe to make up for the long wait, the PK-232 is a classier unit.

The PAKRATT concept is this: AEA decided to put all of ham radio's digital operating modes into one station controller. The PK-232 will run Morse, Baudot RTTY, ASCII, AMTOR, and packet; all modes are selectable from the keyboard. All you have to do is plug a computer into the 232, run a cable over to your rig, and you're on the air!

Front Panel

The first thing that you'll notice about the PK-232 is the front panel and its twenty LEDs. The display is grouped into two sections: STATUS and MODE. Everything that you need to know about your operation is right here. MODE LEDs show not only the five basic modes, but also the "sub-mode" (FEC, ARQ, or Listen) on AMTOR. STATUS LEDs keep you in touch with what your transmitter is doing, what state the PK-232 is in, whether or not you're connected to another station, and so on. In a glance you can see exactly what's going on in the shack.

Two rigs can be attached to the PK-232; the RADIO 1/RADIO 2 switch selects which of them is active. Wiring in both a VHF and an HF transceiver gives you great flexibility of choice; the VHF and WIDESHIFT commands let you pick the appropriate tone pairs for operation on HF or VHF.

A ten-segment LED tuning display makes it very easy to net stations in on RTTY. The display is like a tiny spectrum analyzer which lets you look at the mark and space frequencies of the RTTY signal—with a little practice you can jump right on top of a station and even tell what shift is being used. For the purist, an oscilloscope output is provided on the rear panel.

Modes

The PK-232 handles just about every digital mode available to amateur radio operators. Modes are selected from the keyboard; it takes only a few keystrokes to jump from one to another. Each mode defines special keys to perform certain functions—you can turn your transmitter on and off with Control-X and Control-D, for example. The software folks at AEA spent a little time thinking about the codes to use, and as a result you'll find yourself quickly remembering which letters do what.

- **RTTY**—Typing "BA" from command mode will give you a full RTTY system. The unit will handle Baudot code at five standard speeds: 45, 50, 57, 75, and 100 baud (60, 66, 75, 100, and 132 wpm), selected by the RBAUD command. One blessing is the unshift-on-space feature which forces a switch to letters when a space is received. This comes in especially handy if you're copying things like news reports that have times and dates in them on a less-than-perfect channel. Sometimes the machine will read the shift to numbers but miss the shift back to letters. Without UOS you can end up with a few yards of nothing but numbers on your printout.

Another neat feature is the CCIT command which automatically translates characters into the International Telegraph Alphabet Number 2 used by many DX stations. You can type away and not have to worry about whether what you send as English comes out looking like Serbo-Croatian on the other end.

The PK-232 treats ASCII as a separate mode. Speeds supported are 45, 50, 57, 75, 100, 110, 150, 200, and 300 baud.

- **AMTOR**—This little-understood mode should gain some popularity with the introduction of the PK-232, since the PAKRATT makes it so easy to use. It's a bit complicated at first (there are a lot of obscure names for the different phases of operation), but the AEA manual leads you through an AMTOR QSO step by step, down to telling you which keys to press and when to press them. I think that part of the challenge of AMTOR is just figuring out how to talk with someone!
- **Morse**—The PK-232 deals very well with Morse sent from 5 to 99 wpm. The manual warns you not to expect miracles when trying to copy a poor fist, but I found the decoding algorithm to be pretty forgiving. There's a feature that sends BTs as filler characters, which I found a little annoying. I've always considered Morse keyboards to be a little silly, and this one is no different, but I must say that I was impressed by the 232's ease of use. If you're into CW keyboards, you'll definitely like this one.
- **Packet**—I have to admit that I consider the PK-232 to be a TNC that happens to have RTTY, AMTOR, and CW stuck in on the side. The 232 is a complete AX.25 level 2 TNC, and you can pick either version 1.0 or version 2.0. Up to ten multiple connections are available for those who tend to be slightly schizophrenic.

One of the best features is a complete set of MONITOR commands which let you keep track of who's on the channel, what path they're using, and what time they're on (using the built-in clock). You can also filter out stations that you'd rather not see on the screen, such as crazies who beacon every 10 seconds or BBSs spewing out last week's propagation bulletin. Speaking of beacons, the PK-232 will let you know if it thinks you're beaconing too often! (I think that it should display the "beaconing too often" message any time a beacon is turned on.)

You can switch very quickly from VHF to HF packet just by hitting the RADIO 1/RADIO 2 button and selecting the appropriate tone pair; it takes about 10 seconds.

Overall

I was impressed with the PK-232. As I mentioned, I would buy it primarily as a TNC and justify the added expense by using the other modes now and then. You could, I suppose, buy it as a RTTY TU and use it on packet and CW now and then. The big selling point is that you get all five modes right at your fingertips out of one small box.

The unit is built with the usual AEA attention to quality and I expect it to run practically forever. I didn't have any trouble at all with interference to or from the computer.

If you have any interest at all in using digital modes on ham radio, I would strongly recommend buying the PK-232. Reader Service number 214.■

Heathkit HS-148 Compact PC

by Perry Donham KW1O

Heath Company
Dept. 150-815
Benton Harbor MI 49022
Price class: $900

Number 11 on your Feedback card

You can't go to a hamfest anymore without seeing at least two companies selling IBM PC-compatibles. This year's Dayton Hamvention had six! Hams are buying up these units faster than surplus HTs; I have the feeling that the days of the VIC-20 and C-64 are numbered.

The reason that these units are selling in such volume is the price/performance ratio. As the price of clones falls, it gets to a point where it's just silly not to buy one. Why spend several hundred dollars on a C-64 with a monitor and drives when for a few hundred more you can pick up a computer that's IBM-compatible and comes with 360K drives and 256K of RAM?

The real question, then, is where to buy your

computer. I spent several months wandering the hamfests, observing seedy-looking salesman handing out mimeographed information sheets. The prices were fine, but somehow I didn't believe that I would get much support if I ever needed help. Then one day I wandered into the Heath booth.

Heath's HS-148

Heathkit sells several PC-compatibles. I chose one on the low end of the scale since I really didn't need coprocessors, multitasking, and networking. The HS-148 kit seemed to perfectly fill my requirements for a low-cost, multipurpose machine that would let me do word processing, programming (in languages other than Basic), and would have the ability to control the shack.

The basic HS-148 comes standard with 256K of RAM (expandable to 640K), one 360K half-height disk drive, a monochrome monitor, and the MS-DOS operating system. The keyboard is full-size (including 10 function keys) and has an excellent feel. Both composite monochrome and RGB video are supported, and one parallel and one serial port are brought to the back panel.

The processor is an 8088 16-bit CPU running at 4.7 or 8 MHz. A front-panel switch lets you select the clock speed; so far I've toggled to 4.7 MHz only once, to see how much slower things ran (noticeably slower). There's a spot for an 8087 numeric coprocessor, and Heath offers the chip as an option for $285. I can't think of many applications that need the extra number-crunching capability, especially in a home environment.

All of the cabling for drive B is in the kit. Heath's second drive retails for $200; I suggest buying one mail-order for half the price (Jameco has one for $109). As long as the drive is PC-compatible you should have no trouble—just bolt it down and plug it in. Wherever you get it, it's well worth the extra price for the second drive.

There are no expansion slots on this machine. You've got the built-in parallel and serial ports to work with, but if you need more than that you'll have to buy the ZA-141 Daughter Board for $99. This unit is installed above the I/O board and allows the use of one additional plug-in board (a standard PC has seven expansion slots). I have a couple of applications that require joysticks, so I'll probably end up using the ZA-141 in conjunction with the PCS-110 Game Port ($69.95).

Construction

The computer came in two giant boxes. It took about ten minutes to pull everything out, and only another hour to completely assemble the system. There is no soldering going on here—you just bolt things down and plug them in. I knew it would go quickly, but I was still surprised when I looked at my watch! The construction manual is very thin; about half of it deals with installing disk drives.

The computer comes in two parts, a CPU section and an input/output section, which are connected to each other with a 60-conductor cable. Sockets for two additional banks of RAM are provided on the CPU board. Expanding memory to 640K is extremely simple—you just plug the memory in and set a few DIP switches to tell the processor how much RAM to expect. It takes about three minutes. I would suggest not buying extra memory from Heath. I hate to keep knocking Heath add-ons, but they tend to be a bit pricey (their 256K RAM sets are $80, while you can pick up the same parts at Jameco for about $30). If you're not comfortable mucking around inside a computer, spend the extra bucks and get Heath's excellent instructions and support.

Operation

Once things were all together, I raced through the diagnostics and grabbed MicroSoft's Flight Simulator off the shelf. I figured that if the HS-148 could run this, it could run anything! I managed to fly right into the Statue of Liberty with no problem.Some of the packages I've run are WordStar, SideKick, CrossTalk XVI, and the Perfect series of integrated software, all with no hitches.

I'm Happy

I've been extremely pleased with the HS-148 computer. Assembly was a snap (literally!), and the thing has run flawlessly from the first time I powered it up. It's faster than my IBM PC, and smaller and lighter, too. I like the keyboard a lot (better, I think, than the IBM's and infinitely better than Leading Edge's), and the display is sharp. It runs every scrap of software I've fed it without blinking.

The documentation is about as heavy as the computer and *very* complete. You also get a set of docs for MS-DOS. There's more stuff in these books than you'll ever want to know.

Is it worth the extra hundred or so dollars to buy a clone from Heath? I think it is. First, I trust Heath's quality control. I've built several Heath kits and have had no trouble whatsoever with them. Second, I know that if something goes wrong, I can call Heath on the phone and they'll help me. They have people whose job it is to do that. Finally, I can join Heath's User's Group and get access to cheap software!

Heath's Christmas catalog has the HS-148 and all of the accessories in it; you can get a copy by writing to Heath Company, Dept. 150-815, Benton Harbor MI 49022, or check Reader Service number 215.■

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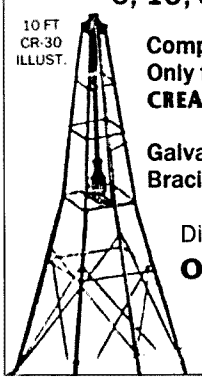
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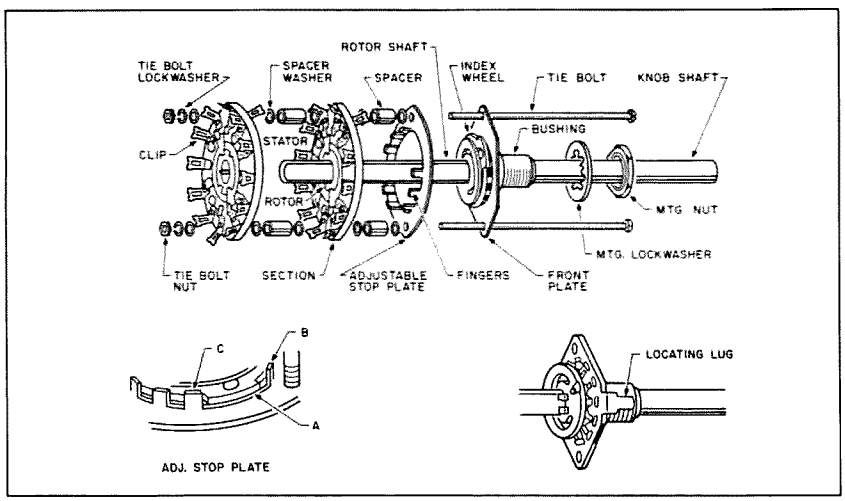


Fig. 1. Exploded view of the Centralab PA-1000 and PA-2000 rotary switch.

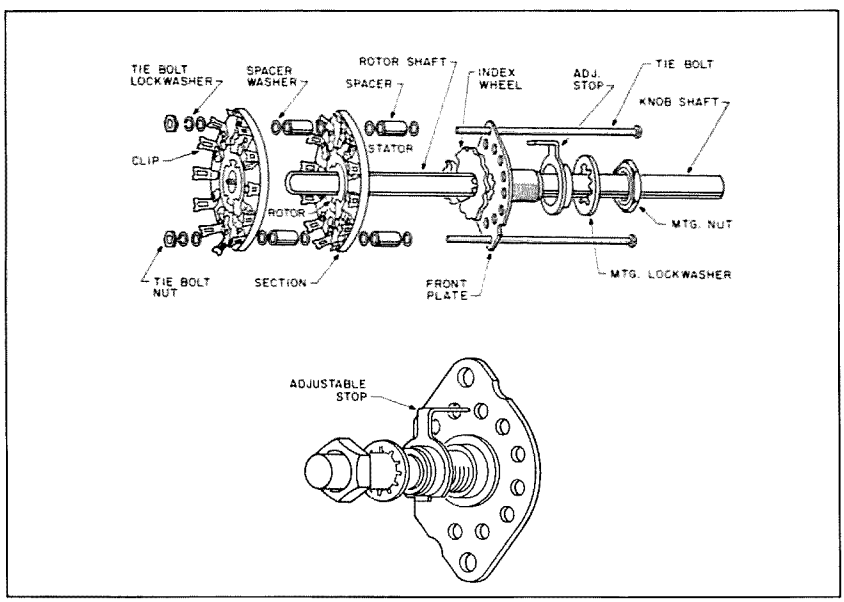


Fig. 2. Exploded view of the 1400- and 2500-series standard rotary switch.

With the introduction of new amateur bands in the HF spectrum, many transmitters, vfo's, and receivers have been rendered obsolete or at least out of place. However, much can be done if you're willing to adapt existing equipment to the new bands. It sure would be nice to expand the range of a vfo with an extra tuned circuit or add a new band to a ham-band-only receiver.

Older equipment usually has multi-position rotary switches which can be rebuilt to make

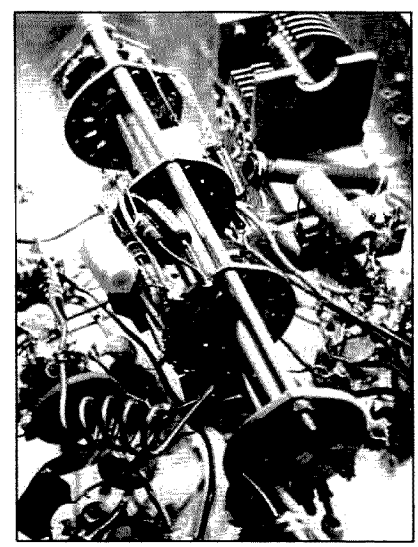


Photo A. Typical medium-power transmitter bandswitch (Allied T-150A) with four gangs or index assemblies (or wafers). The closest gang in the photo is made out of porcelain for the final amplifier. You will need at least a 3/16" screw here. The other thinner phenolic wafers behind this will accept a 1/8" screw. Before obtaining the small 0-80 hardware, check for proper minimum screw length in your own equipment. In addition, perhaps you can use the larger 1-72 or even 2-56 hardware if the wafers and corresponding holes are bigger. Also, the still smaller 00-90 and 000-120 are available. Obtain a catalog!

room for additional LC circuitry. For instance, an 80- through 6-meter medium-power transmitter uses six band positions, but has 11 potential positions in the bandswitch. This article involves the use of these extra positions.

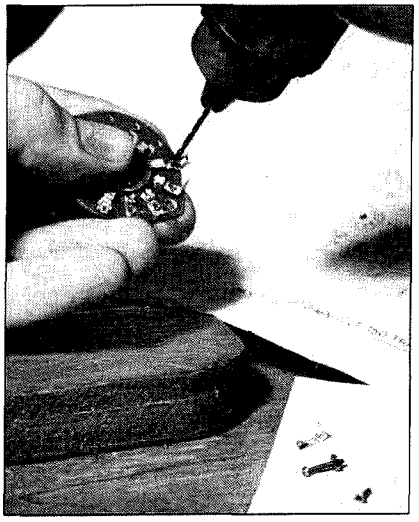


Photo B. The drilling out of slide-contact teeth. Please use a heavy glove when doing this and don't drill toward yourself. Lean the part lightly against a block of wood while drilling. If the wafer jams, let it slip from your heavily gloved fingers and unjam it manually. Believe it or not, I broke a small hobby drill trying to do this. Try not to break a wafer!

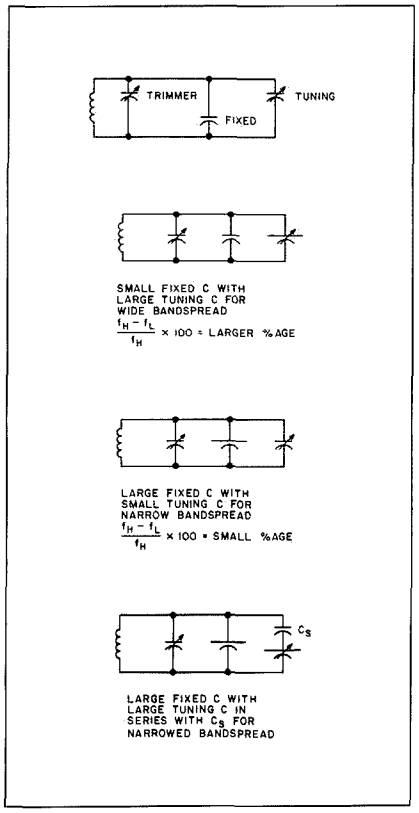


Fig. 3. Methods of varying band-spread.

The rebuilding of the bandswitch by the addition and movement of contact teeth can start with the removal of parts from a junkbox rotary switch of the same manufacturer and type as the bandswitch. Carefully match the make and physical size—bring the junkbox switch to actually touch and match the bandswitch if possible. There are very small and subtle differences among rotary switches, so you must make sure that your switches are mechanically compatible. When you're sure, use a small drill to remove the miniature rivet so you can salvage the slide-contact teeth (see Photo B). These teeth are then fitted into the unused holes of the index assemblies (or "wafers") on the bandswitch being converted.

Additionally, you probably need to shift some teeth on the bandswitch (see Photo C) by drilling out inappropriate tooth fasteners and shifting around the loose teeth to appropriate locations. (Do I sound like a dentist?) To position the drill at a good angle, the bandswitching assembly will have to be loosened from its position and, in case of multiple sections, removed. See if you can get away with not having to remove the whole

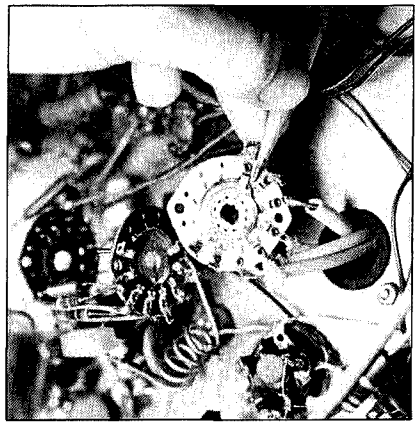


Photo C. Bandswitching wafer from an Allied T-150A transmitter (80 through 6 meters) with added band position. Long-toothed contact at 7 o'clock had just been shifted one stop clockwise and resulting space replaced with a short-toothed contact. Notice the two small screw heads holding their respective contacts. Also notice how this index assembly and the ones behind it are hanging on by their leads—switching shaft and pillars are removed. Back in it all goes.

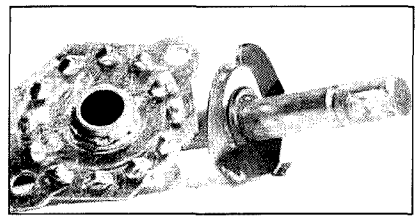


Photo D. Custom stop plate on T-150A bandswitch (originally made for six positions) showing former stop at 8 o'clock after having been banged in and flattened with a nail-set tool. The other stop at 2 o'clock was left alone (look carefully). "Index wheel" sits on shaft and is disassembled from the stop plate in this photo. Single tab on index wheel hits stop in assembled position. Note that this former 6-position stop is now an 11-position stop, as the index wheel now can travel 330 degrees instead of 180 degrees. A new stop has yet to be fashioned to limit travel to 210, 240, or 270 degrees depending on whether 1, 2, or 3 new WARC bands are to be designed into the transmitter (or receiver).

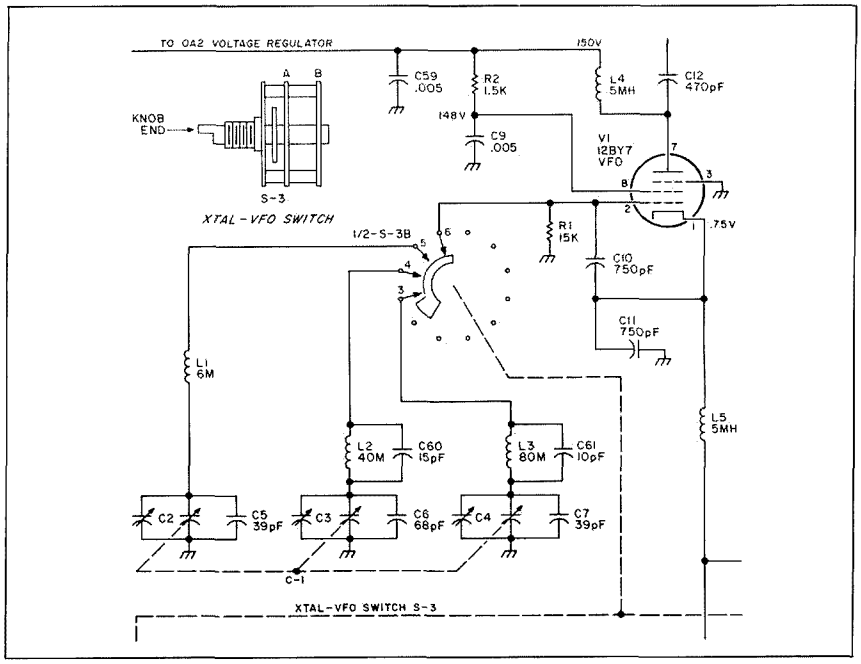


Fig. 4. The vfo circuit of the Allied T-150A transmitter. The 80m tank oscillates on 160m, and the 40m tank is on 80m. The 6m tank runs from 8.333 to 9 MHz.

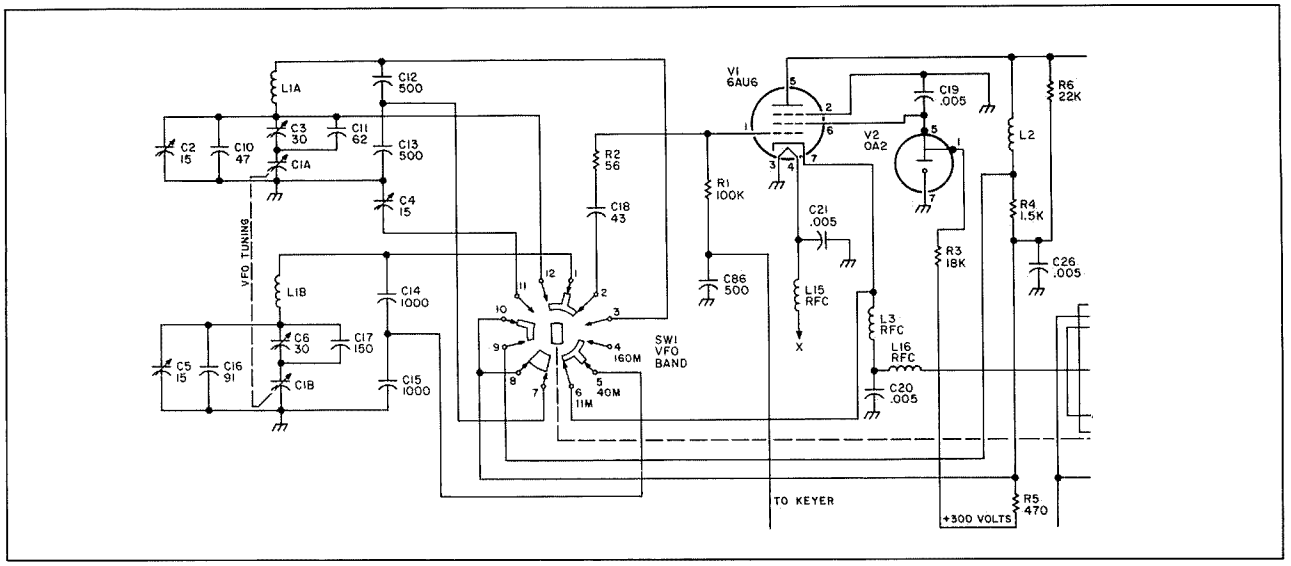


Fig. 5. Note the number of capacitors used in the Johnson Ranger's tuned circuits. The unit covers 80, 40, 20, 15, 11, and 10 meters.

bandswitch. But if you can't, don't be afraid to perform major surgery.

Isolating the bandswitch from the unit and working on it separately is the best approach (see Photo D). The good thing about a bandswitch is that everything comes apart and goes together again—it is mechanical. Don't lose parts, remember their order of removal, and don't use too much force.

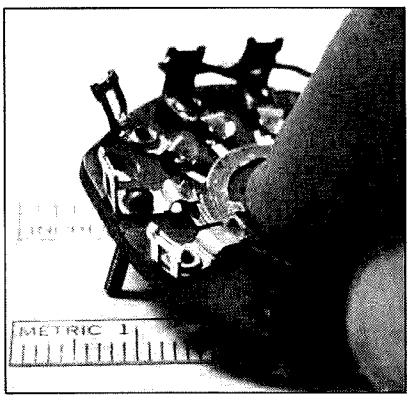


Photo E. Close-up of index assembly showing contact tooth fastened with 0-80 hardware. The 0-80 screw in this photo is a little longer than needed. Note fingers holding wafer.

The individual index assemblies will have to be twisted out of position by removing the two pillars—one on each side. Remove the two long screws running the length of the bandswitch—the tie bolts. *Loosen the tie-bolt nuts, not the screw heads!* Pull out the bolts, and the pillars will fall from position. The wafer indices now will be hanging on discrete parts, or vice versa. Now you are better able to position the wafers for drillouts and modification.

Hardware of 0-80 size (see Photo E) fits the holes and contact teeth of most bandswitching wafers in receiving and low-to-medium-power transmitter circuits of slightly earlier vintage. Make sure you determine the types of new teeth you need to install: the "make" (physically shorter) or "always on" (longer) type. Also, you will have to adjust the stop to give the rotary switch an extra position or positions to travel.

Some stop plates (front of bandswitch) have adjustable stops, but most bandswitches do not since they are usually custom-built. You will have to flatten in the appropriate stamped-out stop (perhaps with a nail-set tool) and devise a way of stopping the switch travel at its new limit and not beyond: I soldered heavy wire pieces onto the stop plate. Other ways are banging in your own stop or adding a small screw—or you can leave it alone (not recommended). Save all the parts carefully and reassemble in the proper order! Also, relabel the front panel as needed.

You can order separate rotary-switch index assemblies through manufacturers' catalogs, choosing your required switching sections, shaft parts, and shaft flat angles (angles at which the switch stops). Another approach is to cannibalize the index assemblies themselves as units and make up your own custom switch. The problem here is that even with a large rotary-switch junk box at your disposal, you probably still won't find every index assembly you need. This is why I go right for rebuilding on the individual slide-contact tooth level. I've gotten to like 0-80 hardware.

Please remember not to tighten tie bolts by their screw heads. Tighten the nuts instead. Also, separate the metal nuts on the ends of

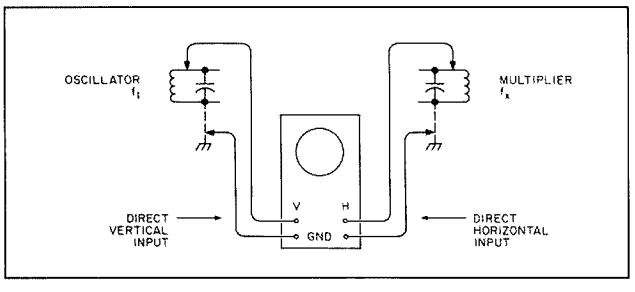


Fig. 6. Use an oscilloscope to determine the multiplication factor of a multiplying stage.

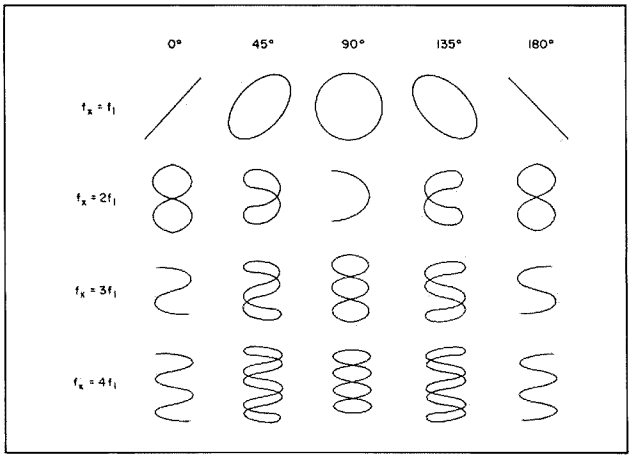


Fig. 7. Lissajous patterns for use with the method in Fig. 6. (Adapted from the Practical Oscilloscope Handbook.*)*

the tie bolts with the phenolic washers and then the split rings before tightening.

Once you have planned your work and installed the new physical switch positions, you must add appropriate LC circuits. Consult the *Handbook* and pull out the grid-dip meter. A few tips will save you time. Say you have an old transmitter that you're converting: Try getting to a flea market to find the same transmitter in fair condition at a good price. Remove whatever coils, brackets, etc. that are needed and add or subtract turns to salvaged coils that are peculiar to the equipment. You'll have your coils, trimmers, lots of spare parts, and less available storage area!

Old TVs and radios have nice coils and cores, a few of which may suit your need with some modification. Also, you can wind a fixed coil using a megohm-size resistor as a coil form. Note that some buffer-circuit coils have shunt resistors anyway and range in value from around 5k to 10k. Coils might even be customized using old rf chokes or coils from which the original winding was removed. An unknown here would be core permeability, so you'd need to experiment with winding your coil. Another approach is to sacrifice the LC circuits of an original band for a new band—winding or unwinding wire on the coil forms and juggling capacitors. Here, you will not need to rebuild the bandswitch mechanically.

The methods suggested here are cut-and-dry. Using some observation, you can look at the 40-meter and 20-meter coils to get an idea of what the in-between 30-meter coils should be like. (Do the same for the 17- and 12-meter bands.) Again, use the grid-dip meter if available, space trimmers and cores at halfway points, and interpolate fixed capacitor values using the NPO types.

There is a bit of a problem with the new ham bands. In addition to their inconvenient locations—on odd frequencies—they are very narrow, making band-spreading a problem. A glance at Table 1 shows bandwidths for these new WARC bands of only 0.4% to 0.55% when compared with the spectrum space below and including each one, whereas the traditional bands vary from 2% (15m) to 12.5% (80m). This means a careful selection of LC components is required to obtain comfortable band-spreading.

This article is a guide, and the table I drew up is to help you with the relative numbers for converting LC circuits in vfo's, receiver rf amplifiers, and antenna circuits. Some equipment, such as a general-coverage receiver, defies conversion. Other equipment, like the Viking I and II transmitters, containing variable inductors in the final, might possibly operate on the new bands with little or no conversion if they had a converted vfo or odd-frequency crystals. (It would be good to hear from those who already have some experience in this area.)

In the case of frequency multiplication, there is the possibility that the doubler, tripler, or quadrupler may be tuned to the wrong frequency! Good output on the wrong

Bands in Meters	f_L Lower Limit MHz	Mean f MHz	f_H Upper Limit MHz	Width in MHz	% Spectrum from f_o	% Spectrum Below 30 MHz	$f_L/2$	$f_H/2$	$f_L/3$	$f_H/3$	$f_L/4$	$f_H/4$	$f_L/6$	$f_H/6$	$f_L/8$	$f_H/8$	$f_L/12$	$f_H/12$	$f_L/16$	$f_H/16$	$f_L/18$	$f_H/18$
160	1.8	1.9	2.0	0.2	10	0.667																
80	3.5	3.75	4.0	0.5	12.5	1.667	1.75	2.0														
40	7.0	7.15	7.3	0.3	4.10958	1	3.5	3.65	2.333	2.4333	1.75	1.825										
30	10.1	10.125	10.15	0.05	0.49261	0.1667	5.05	5.075	3.3667	3.3833	2.525	2.5375										
(New)		λ=29.63m																				
20	14.0	14.175	14.35	0.35	2.43902	1.1667	7.0	7.175	4.667	4.7833	3.5	3.5875										
17	18.068	18.118	18.168	0.1	0.55041	0.333	9.034	9.084	6.02267	6.056	4.517	4.542	3.01133	3.028								
(New)		λ=16.56m																				
15	21.0	21.225	21.45	0.45	2.0979	1.5	10.5	10.725	7.0	7.15	5.25	6.3625	3.5	3.575								
12	24.89	24.94	24.99	0.1	0.40016	0.333	12.445	12.495	8.29667	8.333	6.2225	6.2475	4.14833	4.165	3.11125	3.12375						
(New)		λ=12.03m																				
CB	26.965	–	27.405	0.44	1.60554	(1.4667)																
Old 11	26.9	–	27.36	0.46	–	–	13.45	13.68	–	–	8.725	6.84	Old 11-meter vfo's									
10	28.0	28.85	29.7	1.7	5.7239	6.667	14.0	14.85	9.333	9.9	7.0	7.425	4.667	4.95	3.5	3.7125						
6	50.0	52.0	54.0	4	7.4074	–	25.0	27.0	16.667	18.0	12.5	13.5	8.333	9.0	6.25	6.75	4.1667	4.5				
2	144	146	148	4	2.7027	–	72	74	48	49.333	36	37	24	24.667	18	18.5	12	12.333	9.0	9.25	8.0	8.222
Classical amateur bands																						
as % of spectrum below 30 MHz						11.667																
New and classical amateur bands																						
as % of spectrum below 30 MHz						12.50																

Table 1. For vfo conversions. Before modifying, double-check any numbers for errors! 6 and 2 meters are covered here because these vfo bands fall in the HF spectrum. 11 meters (now CB, of course) was included since some of the early vfo's and transmitters contain the old 11-meter ham band (Johnson Ranger and others). Also, you may find a CB vfo. These should be easy to convert to 12 meters. Note that a 2-meter vfo at 9 to 9.25 MHz (f/16) will cover 17 meters on f/2. Also, a 6-meter vfo at 8.333 to 9 MHz (f/6) can be detuned on the low end to cover 12 meters (f/3). However, you may consider the band-spreading on the first to be inadequate without further conversion. Some combined 6- and 2-meter vfo's have "continuous" band-spread from 8 to 9 MHz. The f/18 of 2 meters is from 8 to 8.222 MHz, but the dial will go to 8.333 as the upstairs 6 meters extends from 8.333 to 9 MHz (f/6) with the same variable capacitor. This is good for 12 meters with reasonable band-spreading. 30 meters is more difficult. If you can get an 80-meter vfo on "90" meters, then you have f/3. Band-spreading is still a problem without more work. "Percent spectrum from f_o" column: $(f_H - f_L)/f_{H} \times 100$ = % spectrum from f_o (0 Hz), and was computed for band-spreading purposes.

harmonic can be confusing. Fig. 6 shows a setup for determining the frequency of an amplifier or multiplier as compared with the frequency of its preceding stage. A broadband oscilloscope is connected to the tank circuits of the stages under test using direct input with the shortest possible leads—the vertical input coming from the oscillator stage and the horizontal input from the multiplier stage.

The corresponding Lissajous pattern (Fig. 7) yields the ratio of multiplication (and phase-difference angles). Switch off the internal sweep on the scope, put the sync selector switch on external, and set both gain controls to zero. Then switch on the transmitter stages and adjust the scope gain controls. Compare your Lissajous pattern for the answer as you tune the buffer/multiplier. If you obtain other unwanted harmonics, avoid those control settings in the future—or better yet, try to design them out. As you may be putting in your own multiplier circuits, try to eliminate unwanted multiplication by adjusting LC values. Again, coil sizes and capacitor values can be interpolated from those on adjacent bands.

There is still much older equipment around with good solid names like Johnson, Heathkit, National, Hammarlund, etc. A lot of the tube stuff will never see 30 meters and the other new bands unless we get used to the idea of conversions. Good luck with all attempts! ■

Parts and Information

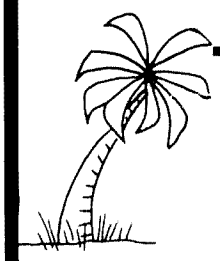
Small Parts Inc. PO Box 381736 6901 NE Third Ave. Miami FL 33178	0-80 x 1/8" screws MX-080-2	10 for $1.05 25 for $2.15
	0-80 x 3/16" MX-080-3	10 for $1.10 25 for $2.20
	0-80 hex nuts HNX-080	10 for $0.75 25 for $1.40
	size #0 lock washers LWX-0	10 for $0.75 25 for $1.40

•This company issues a comprehensive catalog. $5 minimum billing and $1 service charge for orders up to $10.

D.R.I. Industries, Inc. 11300 Hampshire Ave. South Bloomington MN 55438-2498	0-80 x 3/16" cat. 20176100	25 for $0.94
	0-80 hex nut cat. 20176500	25 for $1.85
	size #0 *flat* washers cat. 20176600	25 for $1.04

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A VOX In A Box

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Number 2 on your Feedback card

Current technology offers seemingly limitless equipment opportunities for the CW operator. We are all familiar with filters, memory keyers, keyboards, and visual display readers. *73* has provided us with construction articles for most of these accessories.

Many people feel that keyers are responsible for improving the average fist heard in the CW subbands. Furthermore, the memory feature is indispensible to the contester. It would be nearly impossible to find a high-scoring contest station that doesn't use a memory keyer. The memory advantage is that the operator is given a few free moments for logging, duplicate checking, or other things. Most people find it's difficult to write left-handed while simultaneously sending CW with the right hand!

This is well and good, but it doesn't do much for the phone contesters or other hams who like SSB. They might feel somewhat left out with respect to operating aids. Consequently, I would like to offer my contribution, however small, in the form of a closed-loop cassette tape for CQing or other purposes. Here, the primary advantage is being able to speak after 24, 48, or ?? hours of phone operation.

This is not an original idea, but rather an improvement that provides a way of automatically synchronizing several messages and turning the recorder off after each individual message. Naturally, the recorder could be manually timed, but that requires paying enough attention to remember to release the switch before the beginning of the next message. Anyway, why should the operator need to perform such a menial chore when a much lazier, that is, more time-effective method is available?

I have found that a 20-second closed-loop tape (Radio Shack 43-401) allows the recording of three CQs and still provides time for the recorder to come up to speed. This tape-loop controller is a fairly straightforward circuit to build and does not require any test equipment to calibrate.

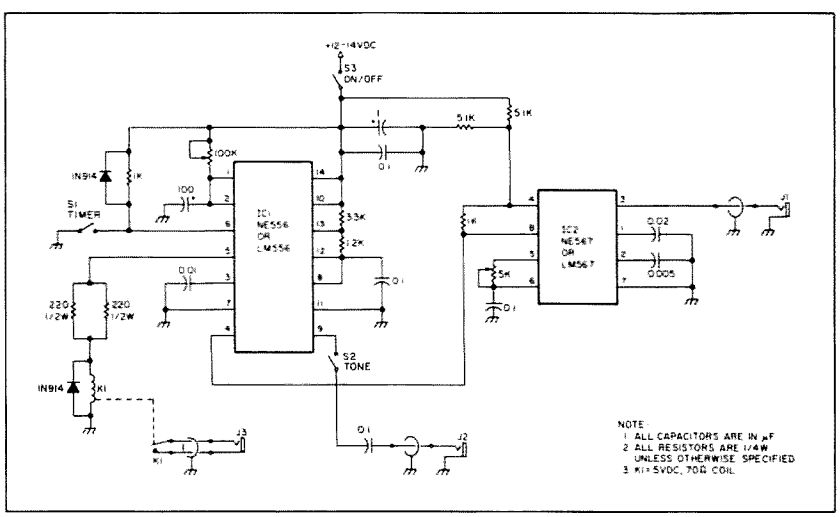


Fig. 1. Schematic diagram of the Accu-VOX controller.

The IC that controls the recorder is an NE556, which consists of two NE555 chips in one package. In our case, the 556 IC is wired both as a timer and an oscillator. A glance at the schematic (Fig. 1) indicates that the circuit also involves a tone decoder. Before you get into the entire circuit, it might be helpful to become familiar with the basic 555 IC itself. If this is old hat for you, just jump ahead to the next section.

The NE555 can be wired to perform either of two functions: a timer (one-shot device) or an oscillator (astable vibrator). The timer produces a constant output voltage for a time approximately equal to the time constant of an external resistor-capacitor combination using the formula: time (seconds) = 1.1 x RC.

As shown in Fig. 2, this device can be wired to be in the normally on mode rather than being normally off.

The timer is started by applying a negative voltage pulse at pin 2, which is the trigger pin of this IC. Additional triggering pulses applied before the device times out have no

Pin No.	Purpose
1 (7)	Discharge
2 (6)	Threshold
3 (5)	Control voltage
4 (4)	Reset
5 (3)	Output
6 (2)	Trigger
7 (1)	Ground
8 (2)	Trigger
9 (3)	Output
10 (4)	Reset
11 (5)	Control voltage
12 (6)	Threshold
13 (7)	Discharge
14 (8)	4.5–18 V dc

Table 1. NE556 pinout table. Numbers in parentheses are the corresponding NE555 pins.

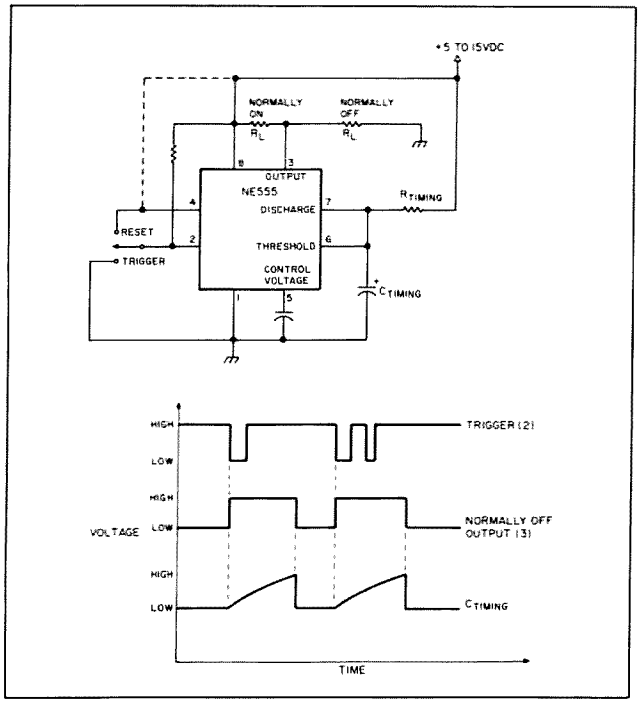


Fig. 2. Wiring and waveform diagrams for an NE555 in timer (monostable) mode. Output pulse (seconds) = R_{timing} x C_{timing}. Note that output duration is unaffected by multiple triggering pulses.

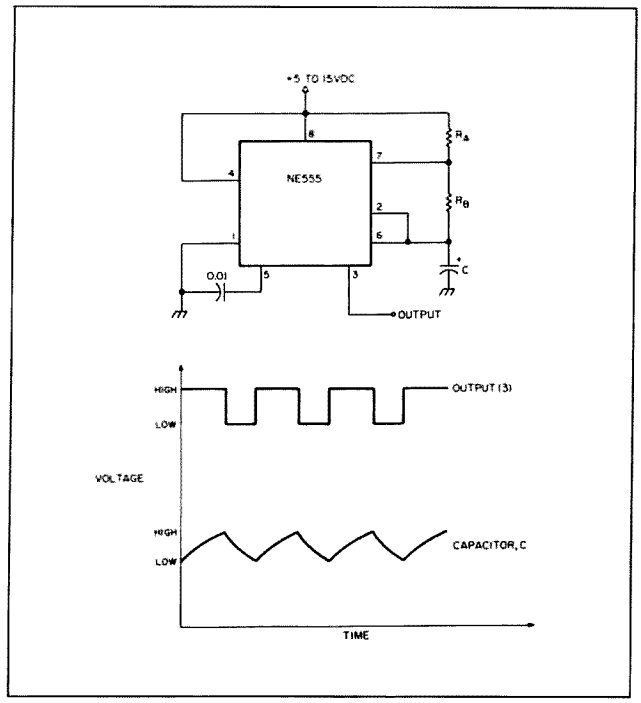


Fig. 3. Wiring and waveforms for astable (oscillating) mode of operation. Output high (seconds) ≈ 0.7(R_A + R_B)C. Output low (seconds) ≈ 0.7(R_B)C. Frequency = 1.44/(R_A + R_B)C.

effect. However, a negative pulse applied to pin 4 during this time will reset the output to its normal (off) state. When the reset feature is not used, it should be connected to the supply voltage to prevent false triggering.

The small capacitor at pin 5 provides an internal reference voltage. The chip is powered by a 5–15-V-dc supply connected between pin 1 (ground) and pin 8. Bypassing the voltage supply at pin 8 to ground with a 1.0-uF and a 0.1-uF capacitor will help keep voltage transients out of this linear IC. The output voltage appears at pin 3 and is about 0.5 volts lower than the supply voltage. This output can source or sink up to 200 mA. The output can be set from less than a second to 15 minutes by proper selection of the resistor and capacitor connected to pins 6 and 7. Substitution of a potentiometer for the fixed resistor results in a timer with a variable latch time.

The wiring diagram in Fig. 3 converts the timer into a square-wave oscillator. This circuit is also called a free-running multivibrator by people who don't like complicated names like oscillator. The frequency of this oscillator is determined according to the following equation: f = 1.44/(R_A + 2R_B)C.

Fig. 3 also shows the waveforms that are present at the more important points of the circuit. Armed with this information, it is a simple matter to make a 10-minute ID timer, code-practice oscillator, or whatever.

Accu-VOX Circuit

A basic timer will not work for the Accu-VOX controller since each of the several messages cannot be made to be the same precise length. The timer would soon become out of synchronization with the messages and havoc would be upon us. The solution is to encode a tone on the tape after each message using the oscillator section of the NE556. Table 1 shows the NE556 pins and the corresponding ones for the NE555.

Another IC, an NE567, is used to decode the tone burst and reset the timer, thus turning

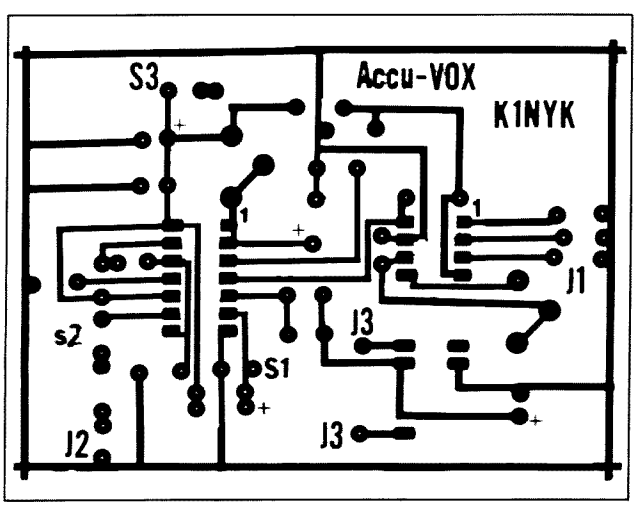


Fig. 4. PC board, foil side.

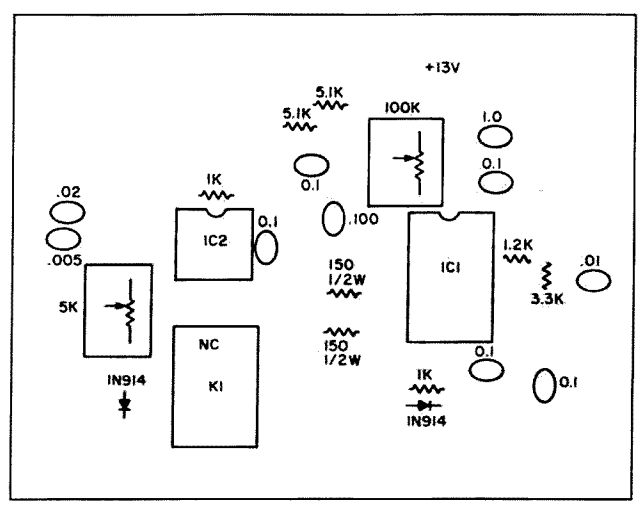


Fig. 5. Parts placement.

off the tape. While TTL chips such as the 74LS121, which draw less current, could have been used for the timer section, the 556 IC requires a less critical supply voltage, reduces the parts count, and is more readily available. In fact, all parts for the Accu-VOX can be obtained from Radio Shack stores or mail-order houses.

The one-shot timer is set to provide a variable delay with a maximum 10–11-second output high, during which time the recorder PTT jack is shorted. Any time longer than each individual message length would be satisfactory. In this case, the length of each message is one-third of the 20-second tape loop.

A reed relay was found to provide more reliable recorder switching than the transistor switch used initially. The diode across the relay coil eliminates back EMFs that are generated when the coil field collapses. The two 220-Ohm resistors drop the output voltage to be compatible with the 5-V-dc relay coil. This circuit can also be powered by a 5-V-dc supply. In this case, the two resistors in series with the relay should be eliminated along with the two 5.1k resistors attached to IC2.

An audio tone of about 2600 Hz was chosen for the encoder so that it would be outside the typical 2200–2400-Hz passband of most SSB transmitters. A potentiometer allows the adjusting of the NE567 decoder to the fixed frequency of the encoder. The decoder operates at a frequency equal to the reciprocal of the RC time constant. The resistor in question is connected between pins 5 and 6, while the capacitor is wired from pin 6 to ground. The output of this chip provides an internally saturated transistor switch to ground at pin 8 when the input signal is within its passband. This requires that pin 8 be biased, which is the job of the 1k resistor between pins 4 and 8. When pin 8 goes low, the resulting negative pulse resets the 556 timer and the recorder is turned off by removing the short on the recorder PTT jack.

There is nothing critical about building this device, although the bypass capacitors should be located as close to the integrated circuits as possible. Point-to-point wiring on a small piece of perfboard is satisfactory, although a better quality product will be obtained with an etched PC board. The PC board, foil side, is shown in Fig. 4. When using an epoxy PC board, I find it's very helpful to hold the completed board up to a light to find any missing or partially soldered connections. The Bakelite™ boards do not allow this trick since they are opaque. Installing the board in a metal enclosure instead of a plastic one will help keep the transmitted rf out of the controller circuitry.

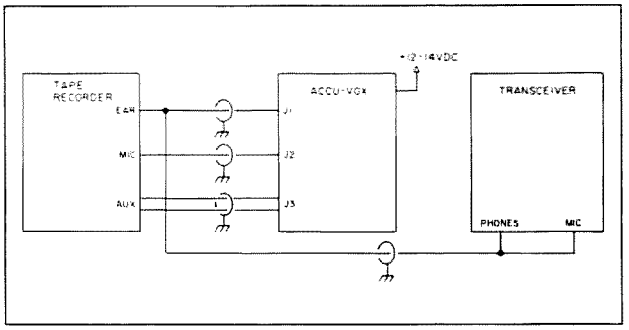


Fig. 6. Interconnection diagram for Accu-VOX.

Alignment of the decoder frequency is simple and only requires a voltmeter. Short the mike and earphone jacks together and attach the meter to pin 8 of the decoder. Close S2 and S3 and adjust the 5k potentiometer until the meter reads about zero volts. The optimum pot setting is in the middle of the null voltage passband. Don't forget to remove the short between the two jacks.

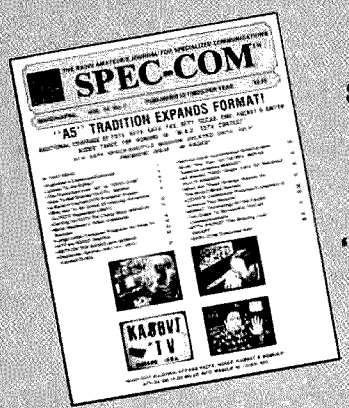
The following recorder characteristics are necessary: ac operation, rapid deceleration, and remote mike and PTT jacks. Ac operation is necessary because the current drain is too high for battery operation. I have encountered no rf problems with the ac supply. When such problems are encountered, they can usually be eliminated by winding a few turns of the ac cord around a toroidal core. A rapid motor deceleration is necessary since the recorder motor must stop, rather than slow down, when the PTT switch is opened. This eliminates sequencing problems as well as sending highly distorted audio to the transmitter. The PTT jack is used as explained above. The remote mike is required since internal condenser mikes can pick up too much of the motor noise and also make decoding the tone burst more difficult. Fortunately, most recorders comply with these simple requirements.

After each message is recorded, connect the encoder output to the mike jack and momentarily close the two push-buttons on the controller. This will start the recorder and record the tone burst on the tape. The recorder must be manually turned off after recording each tone. The tone burst can be quite short (e.g., 100 ms) since the decoder's PLL will lock onto the tone very quickly (e.g., 10 ms) at this frequency.

The recorder, Accu-VOX, and rig are then interfaced as shown in Fig. 6. This will allow you to hear the audio from the recorder as it is being sent to the transmitter. With the rig in the VOX (or closed-PTT) mode, momentarily depressing trigger switch S1 will turn the recorder on and transmit one complete message. Closing either S1 or S2 while the message is being sent will have no effect.

I hope you find that this controller will allow your voice to survive the rigors of future SSB operations. See you in the next contest! ■

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Split That Audio!

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Number 3 on your Feedback card

Contesting and home-brewing are what I like best about ham radio, and it's a lot of fun to combine them from time to time. One problem with contesting is that it can take up a lot of time (much of which could be spent sleeping) if you get really serious about it. This situation helped to create a category known as multi-operator, single transmitter. For the uninitiated (well-rested), the multi-single station allows many people to operate one transmitter and thus divide the time up among them. Another feature of the multi-single class is that two or more people can operate together. In this case, a separate receiver is usually involved, so that the second op can hunt for new multipliers while the primary op tries to maintain a high QSO rate by CQing.

It is important for both operators to be able to listen to either receiver at will. A headphone splitter typically provides this capability but can have some drawbacks. This is where the plot thickens—i.e., where I get to the point. One problem is that the audio volume often changes as headphones are switched between the two receivers. This occurs because of impedance mismatch conditions. Since the second receiver is muted during transmit periods, the second operator does not know when his or her partner might need some help pulling a station out of the noise level, QRM, etc. Herein lies the other problem.

Both of these disadvantages are eliminated by modifying the basic headphone splitter circuit shown in Fig. 1 to that of Fig. 2. The modified circuit could also be useful for casual listening where two operators wanted to listen to the radio without using the speaker. The 3PDT switches provide individual receiver selection, constant impedance matching, and sidetone capability. The 10-Ohm, 1/4-Watt resistors avoid the attenuation problem mentioned above. The remaining set of switch contacts allows the sidetone to be heard whenever the station is transmitting. This feature is provided by the transmit relay in the secondary transceiver.

Relay contacts are only provided for the secondary headphones since it is doubtful that the primary operator would listen to the outboard receiver during transmit. If this capability is desired, the unused relay contacts are available and can be wired in a similar fashion.

Some transceivers have a monitor feature to allow the operator to sample his or her transmitted audio. The output of this device could also be connected to the splitter circuit for SSB operation. This is unnecessary with the newer Kenwood (and some other) transceivers in which the monitor feature supplies both the CW sidetone and the SSB sampling.

Power for this circuit is supplied by a small wall transformer. A three-pin voltage regulator was used since the transformer on hand exceeded the 12-volt maximum allowed by the relay coil. There would be no need for either the transformer or the regulator if the proper supply voltage were available from the transceiver itself.

This circuit made no attempt to incorporate individual volume controls, although a pair of LM-386 audio amplifier ICs would work nicely. A generic amplifier circuit with a gain of 20 is shown in Fig. 3 for those who might be interested. All resistors are 1/4 Watt, and the capacitors should have a minimum voltage rating of 25 V dc.

Building the splitter is straightforward and requires only a box large enough to mount the various components. I used an oversized cabinet to keep the switches from being too close together. This avoids the awkward silence that follows when the secondary operator accidentally switches the primary op's headphones just before the VR1's full callsign is copied!

We were just kidding about the 250,000 points. Sorry.—Eds. ■

Parts List

K1	RS 275-215
J1–J4	RS 274-252
J5	RS 274-346
S1, S2	RS 275-661
All resistors	RS 271-1301

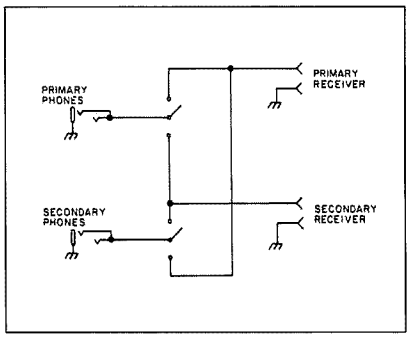


Fig. 1. Simple splitter schematic.

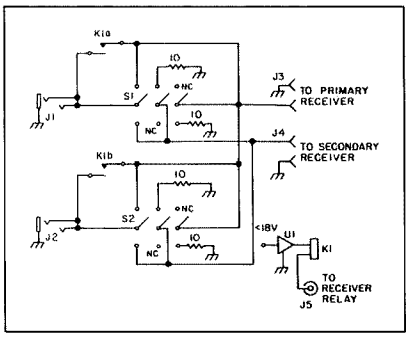


Fig. 2. Improved splitter circuit.

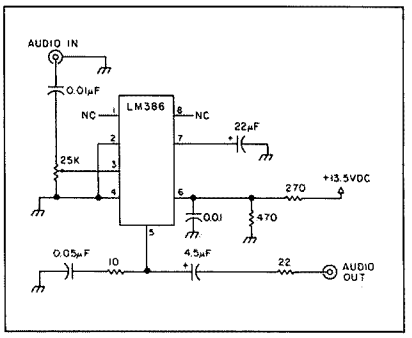


Fig. 3. LM-386 audio amplifier.

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

Nobody Died

. . . but that was the only thing that didn't happen when KT2B and his pals tried contesting for the first time. "Mr. Murphy, meet Pete."

Number 4 on your Feedback card

Although it is many years past and time has somewhat distorted the facts, I'll probably never forget the first time our group made a stab at operating the ARRL September VHF QSO Party.

It couldn't have started out more auspiciously: Here were three amateurs—Ted WA2OHW, Tim WB2OOQ, and me, WB2OHV—newly licensed as of May, 1970, to wreak mayhem on the bands above 50 MHz. Ted was no stranger to amateur radio, as he had been a Novice some years earlier and operated two-meter AM phone. Tim's experience had largely consisted of blowing up a few home-brew stereo amplifiers and wiring up a Knight-Kit 80-6-meter receiver, which actually worked (oddly enough, considering his gift for demolition)!

Myself? I had been an avid pirate radio operator for about five years, taking clock radios apart and putting 12AV6 tubes on 1600 kHz with varied results. I got bored with it, however, and amateur radio seemed the ticket to more excitement. So the three of us took the test and soon received QSL card order forms with our new callsigns from the Little Print Shop in Texas. (Back in those days, that's how you found out whether you passed or not. It took the FCC longer to let you know than Amateur Electronic Supply!)

Initially, our problem was simple: We had virtually no equipment to operate with. Ted had an old Heath HW-20 "Pawnee" rig for 144–148 MHz. This wonder of the western world featured 10 Watts output from a 6360 tube, AM and CW operation, and the most complicated dial cord stringing job seen by modern man. He used conventional RG-8 to feed a Hy-Gain 15-element "Long John" beam and had a respectable signal. For enhanced receive capability, an Ameco CN-144 converter with nuvistor front end was used, driving a Hammarlund HQ-180AC (with clock option, of course).

50 MHz was a distinct possibility, what with Tim's Knight-Kit and an Ameco 50-MHz nuvistor preamplifier ahead of it. Only problem was we didn't have a six-meter transmitter or antenna! 220 and 432 were definitely out of the question. (1296 MHz was right up there with intergalactic space travel as far as we were concerned.)

The immediate problem: Beef up the two-meter station! And we decided to go all the way (never mind our limited construction experience) and build an honest-to-goodness, fire-breathing kilowatt called the "Plumber's Special" from the 1969 ARRL *Handbook*. My father had a fabrication business and this yielded the necessary tubing and metal for the chassis, not to mention the parts for a three-element six-meter beam from the same handbook. (More on this later!)

"Every fuse in Tim's fusebox erupted in a shower of sparks. It was the 4th of July all over again."

Tim was assigned to build the high-voltage supply. This was like asking a pyromaniac to design and install a sprinkler system. Ted was put in charge of scaring up a six-meter transmitter, while I drew the enviable assignment of making up the 144-MHz rf deck. The old man helped out with what he could in procuring parts, and I set to work with a nibbling tool to make the necessary holes in the chassis pan.

Incidentally, nibbling tools should be outlawed as cruel and unusual punishment, especially when cutting out three- and five-inch-diameter holes for blower connections! As a result of hours of flexing the damn thing, I could break small rocks apart in my left hand from overdeveloped metacarpal joints!

Construction proceeded at an erratic pace. Tim located the necessary high-voltage components from Fair Radio and the UPS delivery man suffered a hernia delivering the power transformer. It was a whopper, too—1600 volts @ 750 mA. Tim used solid-state rectifiers from Poly-Paks as well as an enormous quantity of computer-grade electrolytics he scrounged from a barrel at a surplus electronics house nearby.

Ted called me excitedly one night: "I've found a six-meter transmitter! It runs 30 Watts output and uses a vfo!" WOW! A vfo. Now we were in the big leagues. The news inspired Tim so much that he managed to blow up his Knight-Kit receiver by inadvertently connecting ac to the antenna input (I told you he had a knack!), thereby setting our ambitious program back one giant step.

I worked feverishly on the chassis, nibbling away in all my free hours. As high school had recessed for the summer, we each had a fair amount of time to "get it all together," but we still managed to spend most of our time at the beach, the movies, and the local pool. Most of our final assembly took place in late August, by which time Tim had managed to finish the power supply. Ted had successfully repaired the dial cord in his HW-20 (lesser men went to insane asylums attempting the same thing), and I had finished most of the rf deck assembly.

Ah, fate. It can be both kind and cruel. Just when things looked so bleak for the six-meter station, my father got the "bug" and dropped three hundred bucks on a brand new Hallicrafters SX-122, which he agreed we could "borrow" for the contest. Hallelujah! It was off to see John Kakstys W2FNT for a six-meter converter from his used equipment collection. After $15 changed hands, we were back in business. I had also finished building the six-meter beam—entirely out of stainless steel. This had to be not only the most durable six-meter beam on the market, it also had to be the heaviest!

Tim called late one Saturday. "The high-voltage supply is done. Let's check it out!" A few minutes later, we were hunched around

the Masonite meter panel, monitoring screen voltage, plate voltage, and plate current as Tim anxiously threw the switch.

KLUNK. FZZZZZZZZZZTTTTTTTTT. POWWWWWW!!!!

Every fuse in Tim's fusebox erupted in a shower of sparks. It was the 4th of July all over again! The basement went black, and the dreaded voice sounded from the top of the stairs: "TIM! You get up here this minute! What have you done to the television!" Ted and I decided to avoid the lengthy lecture that Tim was being subjected to and went back to Ted's house to plot strategy.

It didn't look too good. Here we were, just a week from the contest, and we still didn't have a decent two-meter amplifier. Not only that, Tim had managed to smoke most of the power supply in his demo, and I came to the realization that even if we had finished the amplifier, I couldn't find any 4CX250s on short notice.

Once again, the fates came to our aid. Ted got wind of a used 5894 amplifier and power supply from a local ham, and armed with $25 (probably his life's savings at the time) closed the deal. Now we could run at least 90–100 Watts if nothing else, and there was no work to be done. He set about integrating it into the station, while I borrowed the 50-MHz setup and attempted to tune the beam.

Tim preferred to keep a low profile until the smoke had cleared, then suddenly announced he would not only fix the supply, but locate the tubes and have the amplifier on the air within a week! (Obviously he had delusions of grandeur. Either that or he believed in the myth of the phoenix!) I took it upon myself to make up log sheets and dupe sheets for the two bands. Ted organized the operating position, and we agreed to meet that Friday afternoon to raise the beams.

The latter was an event in itself. Ted's house had a fairly flat roof, but it was pretty inaccessible. We had to climb from level to level with intermediate ladders to access the top and fasten the rotor, mast, and two yagis. All went well until the ladder fell flat on the second level, leaving us stuck on the roof and Tim with no way to get up from the ground! He decided that asking to borrow a neighbor's ladder was too easy, so he came back with some rope and announced he would scale the side of the house to come to our rescue.

It sounded reasonable, except there was nothing to tie the rope to on the rooftop. What to do? You guessed it, we tied the rope to the mast with the six-meter beam and rotor in place. Tim got up to about the second level before the U-bolts on the chimney bracket gave way and the combination of Tim, mast, antenna, and rotor accelerated at 32 ft/sec^2 until they met the ground with a thunderous crash.

Tim somehow came out of it with only a few scratches, but the mast and beam "bought the farm." Again he had dealt our six-meter station a near-fatal blow, and only a quick trip to the fabrication shop for spare mast and element material saved the day. After this, we chose the safer approach and borrowed three ladders from friends—one for each level. A few hours of groaning and grunting and the six- and two-meter beams were finally in place!

Saturday morning dawned. The contest was only a few hours off now, and we worked at a fever pitch connecting everything together—coax, microphones, rotor cable, lights, converters, receivers, headphones. The log sheets were laid out carefully, and about 50 pencils sharpened. Ted thoughtfully located isolated circuit breakers and marked them with a red pen for easy identification. Yep, we were sure in control. The only thing that didn't make sense was the six-meter transmitter setup.

Here was a homemade unit using a pair of 5763 tubes to produce what the owner claimed was 30 Watts output. Actually, it was more like 15 Watts but so what, we couldn't measure it anyway! Tim relied heavily on a Quement Electronics swr bridge ("Good to 150 MHz!" the ads shouted) to ring out the coax lines, and pronounced everything ready. He had also set up the recently deceased HV power supply in another room, determined to get it working during the contest. A call had been made and a local source seemed promising for the 4CX250s, assuming we could work out a trade, so I reluctantly brought along the rf deck to make Tim happy while he wasn't operating. A last-minute search turned up a CW key, and we were ready to take on the world!

"The stainless-steel six-meter beam was not only the most durable beam we'd seen . . . it was also the heaviest."

Five. Four. Three. Two. One. 2 p.m.! Ted keyed the microphone on the HW-20 and turned towards the plate current meter, mumbling "CQ . . . CQ . . . CQ contest from WA2OHW . . . CQ . . . CQ . . ."

Nothing.

Not so much as a slight deflection. Panic gripped our faces. "Tim!" we shouted. "I didn't do it!" came the response from the next room. A few minutes of searching revealed the answer: We'd failed to provide some means of keying the bias from standby to transmit! Out came the soldering gun, and in a few minutes a hastily wired jumper of #16 speaker wire ran from the amplifier to the Dow-Key contacts. AHHH! That was more like it. From our calculations, we were running about 120 Watts input to the 5894. Ted again started calling CQ, and the band came alive with calls (most of them ignoring us).

I went on six meters and the phone rang about two minutes later. "Whaddyatryintadotamytelevision! You kids outta be thrown in jail I can't watch the game what's all these lines all over the screen knock it OFFF!!!" Click. Ah, well. Never liked that neighbor anyway. He drank too much. I persisted calling CQ and the phone rang again, so we took it off the hook.

Ted got lucky and started running stations. Of course, they were all Big Guns, so his run lasted about 20 minutes and ended abruptly. At least we had about 30 stations in the log! Too bad we couldn't work the "Donald Duckers" on SSB! Six meters was dismal. I couldn't hear a thing! A lengthy inspection revealed a bad piece of coax from the converter to the receiver. In addition, the "standby" jumper was in place, muting the SX-122. These problems were soon rectified and in time I actually started hearing signals! This was exciting!

Tim was furiously laboring in the next room, and the smell of rosin floated through the air. Ted switched to CW and managed to have the key disassemble itself into several pieces including two small springs which he promptly stepped on and flattened for good. "Ah, who needs CW anyway. We'll get 'em on phone!" he cried, and proceeded to call CQ for 15 minutes in the CW position. When he dropped the PTT line, we were greeted with "Hey, you lid! Go tune up somewhere else! There's a contest going on!" At last—we were finally getting out!

Ted's mother showed up with much needed hamburgers around 6:30, and we took a break to chow down and assess the situation. I had managed to work a grand total of 16 stations on six meters since locating the bad cables. Ted had piled up 50 stations on two. It wasn't what we had hoped for, but any port in a storm, as they say! Tim was absolutely determined to get the HV supply working, and his determination paid off—he had completed the repairs by 7 p.m. In order to avoid the previous problems with sparking, he had incorporated some sort of "load standby" switch (the function of which escaped me) to protect against a current surge as the bank of 30 capacitors charged up.

It was agreed that we would operate for another two hours, then take a break to test the supply. If everything worked okay, I'd call the local tube source, get the tubes, and with luck we'd be on by that night with a kilowatt. Sounded pretty easy at the time, so Ted went back on two meters and Tim took a shot at six.

Right away it became apparent that something was wrong with the six-meter beam headings. Two meters peaked fine, but six was almost 90 degrees off! It didn't seem possible, and yet—I ran outside. Sure enough, the six-meter "stainless special" had pinwheeled around almost a quarter turn. Another lousy installation job! I informed the guys of our situation and prepared to again climb the roof to effect repairs when Mr. Drunk from next door sprang out from the nearby azalea bush. "You delinquents! I'm calling the police. This is a damned nuisance! I demand that you stop interfering with—" At this point his foot engaged the coiled garden hose by Ted's back door and he went down in a heap on the back lawn. I scrambled

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back inside, slamming and locking the door behind me.

I'd have to make a try from the second floor. It was definitely hazardous-pay time as I slipped through a bathroom window and carefully stepped along about a foot-wide section of overhang. Upon reaching the end of the window, I managed to slide up the flashing and straddle the roof, edging closer to the beam.

Back in the shack, Ted had hooked into another run of sorts and was logging furiously. Tim still managed to work another ten or so stations off the sides of the beam, and Mr. Drunk gave up and went back to whatever he could salvage of his TV program.

I firmly grasped the mast and stood up, balanced precariously on the roof peak. "Never mind the heights, just fix the antenna!" I thought to myself. I loosened a few nuts and the beam slid down to the rotor cap ever so gently. This would be easy indeed! I removed the mast-to-boom clamps and balanced the beam on the rotor, reaching into my back pocket for longer, stronger clamps.

At that moment, Ted (no doubt caught up in the hysteria of the contest) jerked the rotor to the north, then back south contrary to my instructions to leave it alone. I lost my balance and clutched at the first thing I could grab—the six-meter beam, currently fastened to nothing. Beam and I began a long alpine slide ride down the flashing toward the gutters. As my life flashed in front of my eyes, I also spotted a vent pipe passing by and grabbed hold. The six-meter beam continued by like a stainless-steel avalanche and, with a flourish, flew off the roof to come to a sudden crash on the side of the house. The coax had held! Phewwwww...

Tim chose that moment to come out and inform me of the impending test of the born-again HV supply. He took one look and ran back inside, only to return with Ted and Ted's mother.

"What are you doing up there?" she screamed. I smiled nonchalantly. "Nice view, isn't it?" I said, legs waving in midair. "I'll call the fire department!" she yelled, although Ted persuaded her that that would be unnecessary and soon rescued me with the three-ladder trick.

Now we had a real problem, as the six-meter beam was suspended by an old piece of RG-8 about 15 feet above the ground alongside the kitchen windows. It was decided to take a break and plan strategy as well as test the rebuilt supply.

Tim authoritatively threw the main switch. Again, the hummm and click as before. The lights remained on, however, and the plate voltage meter indicated—lo and behold—2000 volts! He'd done it!

Whatever I thought of Tim's abilities changed at that point, for in the next instant he flipped his "load standby" switch and with an enormous WHUMPPPP the lights in the room dimmed, came up, and started oscillating between on and off at about 60 Hz. The TV picture grew, shrunk, grew again, and shrunk again. The coffee percolator downstairs blew a fuse, the toaster died, the refrigerator ground to a halt, and finally all of the house lights went out in a spectacular flash.

As I sat there in the dark, I contemplated the advantages of stamp collecting. No HV supplies. No antennas. No bad coax. Ted's mother stumbled through the house looking for a flashlight, cursing us to all her ancestors. And at that moment, as if to add a punctuation mark, the coax holding the six-meter beam parted company with its connector, and the beam resumed its appointment with the ground, smashing to pieces seconds later. At least that resolved the six-meter problems!

After much groping in the dark, we managed to reset the tripped breakers and gave up on six meters. Two would be our mainstay for the rest of the contest. We quietly buried the HV supply in the garage and went back to work on two, humbled by the experience.

The evening wore on. We varied the routine with old movies on TV, lots of junk food, and catching sleep here and there. Tim put a yeoman's shift in during the wee hours, and the next morning found us with about 125 QSOs on 144 MHz. The 5894 purred along contentedly and all was well until the rotor stopped.

This was a disaster of major proportions! Losing six meters was bad enough. Tim was dispatched to the attic to locate another hunk of rotor cable Ted "thought" he had left up there. Tim proceeded with haste and began searching the third-floor/attic area. After a few minutes of looking, he swung a door around to check behind it. Click! The door closed in the latch. Clunk! The door handle fell off. Tim panicked and pulled the other knob off, allowing the shaft to drop through to the other side. He was definitely locked in for good!

Ted and I got tired of waiting, thinking Tim had gone back to his house to look for more cable. After about a half hour, we left the shack and went down to the kitchen to get something to eat—far away from poor Tim! His cries for help went unheard as we turned on the television and settled down to stuff our faces.

After about an hour of waiting, we called his house. No, Tim hadn't come home. Hmmm. I tried his neighbor. No, he hadn't seen him. Where could he have gone? Ted decided to look for the cable himself. It was only a matter of time before he found the locked door with Tim flailing away at it trying to break it down. It was HOT in that attic!

Needless to say, Tim lost his appetite for contesting and decided to call it quits Sunday afternoon. Ted and I stuck it out till about 7 p.m. that night when, with four hours to go, the 5894 died. We'd worked about 150 stations on the two bands and nearly 15 sections, so it wasn't a total loss, but it was nearly a year before we decided to try it again!

(Before you ask, yes, the dial cord broke in the HW-20 right as we signed off at the end!)■

Bob Heil K9EID
PO Box 68
Marissa IL 62257

Everybody Equalize!

2 kW into a four-element monster at 90 feet, and still nobody answers your call! Maybe it's because they can't understand what you're saying . . .

Number 5 on your Feedback card

Bob Heil K9EID is the president of Heil, Ltd.

Back in the AM days, it seemed as if everyone was conscious of his audio quality. Many of the signals you tuned across had better audio than the local broadcast stations. Solid lows, crisp sparkling highs, and no distortion—just good, clean, understandable audio. What ever happened to those operators? Most would hasten to answer that SSB came into being and destroyed that great ability to have super audio. Yes, SSB did restrict the bandwidth from around 6 kHz down to 3 kHz. But as time progressed, it seemed as if this bandwidth just continued to get smaller and smaller.

SSB didn't ruin great audio. The biggest factors in the decline of super audio are improper equalization of the microphone line and the transmitter audio-input parameters.

Two-Year Study

A two-year study of the 160-, 75-, 40-, and 20-meter bands has just been completed using very high quality audio analytical equipment. The engineers performing this important study were not amateur radio operators, but professional sound reinforcement technicians and recording studio engineers. Their studies are very interesting—if not shocking! Almost 70%—yes, 70%—of the SSB signals on the air today have very little, if any, audio response above 1800 Hz! Most of these have a huge peak of +10 to +12 dB at 500 Hz and lower, which ends up giving an audio response that looks like a ride at Disneyland, instead of a nice smooth response with a slight rise in the top end for that added punch and clarity so vital to cutting through the pileups.

The first move of an operator who becomes aware of an audio problem is to try a compressor, or clipper, trying to "clear up" these gross problems of improper equalization. In the majority of cases, these types of electronic devices aggravate the problem—their operators don't fully understand how to use them. This causes low-level microphone circuits to be overdriven into horrible clipping, thereby causing massive distortion. The mike inputs of most transmitters are set up to accept 40 to 50 millivolts maximum. Most of these compressors or processors (if you wish) are capable of producing well over 2 volts! In addition, they do very little to improve the lumpy frequency-response curve and simply add distortion as the preamp is overloaded.

Equalization

It is apparent from all of the studies that equalization is the answer. One can use practically any microphone and equalize it to sound perfectly natural on any transmitter. With active equalization, you can adjust the amount of high and low frequency response as needed for a given microphone/transmitter/voice combination.

Recording studios and broadcast transmitters, not to mention telephone lines, PA systems, etc., use some form of equalization to flatten out and equalize the response curve so that you hear the voice as a natural sound, not one filled with extra frequencies and harmonic distortion that have been added by improper electronic equipment.

Bell Laboratories has been studying the phenomenon of human hearing for years. It is a continuing process with this great laboratory to help us understand what we hear and why we hear it. Without any type of equalization in our microphone lines, the transmitter merely sends the audio responses that the microphone and speech audio preamp for the transmitter add to the situation. As Bell concluded, our hearing is very, very sensitive in the mid-range and needs some help in the upper regions, while it is very deficient in the lower extremes. When trying to copy the majority of signals, you'll find they do not have enough mid-range and high responses to them. Most exhibit entirely too much low end and therefore are impossible to pull from the noise and interference of the adjacent signals.

The EQ-300 Microphone Equalizer from Heil, Ltd., can be used to correct this problem. The device has two active audio filters: the low filter at 490 Hz and the high filter at 2400 Hz. Both are capable of a 20-dB boost and a 20-dB cut at those two frequencies, so that equalization of a microphone becomes very easy by simply plugging the microphone into the equalizer and connecting the output of the equalizer into a transmitter's microphone input. Listening to a second receiver (using headsets) while transmitting will allow the operator to equalize the microphone response easily.

Proper Microphone Technique

It is very important to use proper microphone technique to avoid extraneous background noises. Ever tune across somebody and notice that the fan in his amplifier blower is louder than his voice? His explanation that the fan is loud or that he is "running a lot of power" is not the correct explanation of the situation. He is usually speaking 12" to 36" from the microphone with the mike gain cranked and the unequalized processor wide open, causing the background noise in the room to be louder than his actual voice.

Microphones for communication were designed to be very close-talked. It is not proper to sit back away from a microphone and expect to have that commanding signal on the band. The important mid-range frequencies are lost, the highs are diminished, and what gets left are many of the lows and much of the room resonance that overrides just about any audio present.

To correct this and ensure that your signal has that terrific mid-range punch, free from the many extraneous background noise, run the microphone gain as low as possible to achieve good ALC action and speak no more than one to two inches from your microphone. It is the accepted practice in professional communications and it is the only way to achieve good solid audio. This does nothing for the equalization, but does help the signal-to-noise ratio of the audio system.

Microphone Cartridge Response

Surprisingly, the majority of microphones

sold to the amateur radio market are not built by those manufacturers whose name brand they carry. There are only two major manufacturers—in the Orient—that are building most of the microphones. As long as a mike is the same color as a rig and has the correct connector, it is advertised as "matching"—with absolutely no consideration being given to the response, drive, or overall characteristics for use in the amateur radio market.

The majority of microphones are dynamic and produce a very bassy, muddy response. Some of the newer microphones are electret and are even worse in response. Electret elements are very cheaply built and widely used due to the high profit they can produce.

The old crystal and ceramic microphones had wonderful audio responses when used with the older tube rigs. Those cartridges were several million Ohms in impedance and, of course, the tube inputs were also typically 2 to 3 million Ohms, so everything was super sounding. However, here we are in 1986, and all rigs built today use solid-state audio preamplifiers that have, typically, 800 to 1500 Ohms input.

Plugging the wonderful old 1935 D-104, an extremely high impedance microphone, into the new rigs places that cartridge in an almost direct-to-ground short, which does horrible things to this great old microphone. First, the drive is greatly reduced, which is no big deal. However, this terrific mismatch (3 million Ohms to 800 Ohms!) rolls off the low end of the audio and puts a ridiculous peak in the mid-range, making the response sound like a telephone. Yes, it is easy to understand in the pileups when compared to the "stock" dynamic, but it only allows the bandwidth of your signal to become less than two octaves and this just doesn't give you the commanding signal needed in the pileups.

Power Bandwidth

It is important to realize that just having a wattmeter in line doesn't tell the whole story. If you use a microphone that has an extremely peaky audio response, the majority of your power will be at that frequency. Using a stock dynamic mike means that usable parts of your power will be in the low-frequency, muddy-sounding part of the spectrum when your brain is searching desperately to hear from 1500 through 2200 Hz, so the articulation of the words can be understood. Did he say a "P" or a "B"? Was it an "F" or an "S"? Without the proper balance of highs and lows, the brain can't distinguish this—no matter how much power you are running.

100 Watts Beats Out The Big Signal

To really drive this subject home, after several years of study we erected two TA-33 beams at 60′ on separate towers. A stock TS-820S with Kenwood's "matching" MC-50 microphone drove a stock Heath SB-220 amplifier. The second station, located on the same test bench, was a Kenwood TS-120, which was driven with a Heil HC-3 "key element" and the EQ-200 Microphone Equalizer. A $20,000 audio analyzer was attached to the TS-120 and the audio was equalized for maximum response, keeping the Fletcher-Munson curve of the human ear well in mind.

Two amateurs operated the test stations. One station was properly equalized and produced 100 Watts of power into the antenna from 300 to 2400 Hz, with a 10-dB rise at 2200 Hz. The second station was producing 800 Watts of rf from 200 to 1400 Hz, but the output was less than 100 Watts at 2200 Hz. Both stations entered a pileup on the same frequency calling some European stations. In four separate runs, the 100-Watt station was answered first. On the fourth run, the foreign amateur was asked why he answered the smaller station: "Didn't you hear my friend standing here beside me running nearly the legal limit?" The response from the European was, "I couldn't understand any other signals in the pileup but yours!"

The reason for this was that the properly equalized station actually had more talk power at the frequency response that the human ear needs to receive—which made it easier for the brain to make those articulate decisions as to what was said. Stacked KT-34s and parallel Alpha amps are just *not* necessarily the answer. So many times you will hear fellows make that ridiculous assumption—the more power, the better. What we all should learn and learn well is that it is not how much power you are running that makes the difference, but what the audio power bandwidth of that power is.

Become aware of proper audio response. Remember: Hearing is a physical process; listening is a mental process. Become a good listener—improve the sound of your signal and help clean up our airwaves. Art Collins never intended for SSB to deteriorate to some of the signals you can tune across today. ■

EQUALIZATION FOR CONTEST AND DX OPERATION

I recently learned about audio equalization of amateur radio signals, and frankly my first thought was "here we go again, another gadget to clutter up the ham shack." Interestingly, though, I searched further and was able to learn more from Bob Heil, guru of high-quality concert audio systems.

Yes, I do have an MC-50 Kenwood microphone. I bought it because it looked flashy and I assumed that Kenwood designed it for amateur use, but I apparently was wrong. I performed several experiments and found that Heil's treatment of covering the ports of the mike helped the performance by rolling off some of the unwanted low end. In reading several articles by Heil, I thought perhaps there was something to all of this. I was never concerned or even knew about sibilance (the ability of an acoustic system to reproduce without distortion the extreme high frequencies that contain the "S" and "T" sounds). Even with the gimmick-fixed MC-50, I did not get that needed sibilance.

In short, I obtained one of Heil's EQ-200 Microphone Equalizers for testing. To perform the test, I developed a list of words that could be very confusing if the "S" and "T" sounds were missing (Category A). Also, I included words that contained a dipthong (Category B), which requires an extraordinary "puff" of air—enough to drive an unequalized bass-emphasizing mike like the MC-50 or MD-1 crazy. A partial list of words utilized follows:

Category A			Category B	
steam	score	strip	trash	throw
speak	sink	scream	thicket	thrust
scab	space	send	tweed	thwart
scar	stop	tact	twig	throng

These words were utilized in an on-the-air test conducted intentionally under less than ideal conditions—lots of QRN and QRM. During the tests, the listeners were requested to record what they heard and read it back. With the Heil equalizer in line, the listeners were three times more likely to hear correctly what was said.

It must be stated that most listeners first stated that they liked the sound of the MC-50 unequalized, as it sounded more like me. I attributed their preferences to the fact that Americans equate bassness with quality and that they were not used to flat or "equalized" audio. In fact, many thought I was running a processor. Interestingly, a processor in effect eliminates the overemphasized bass of most microphones by clipping it out. Unfortunately, the combination of overdriving the speech amplifier of the rig with overdriving the processor causes much of the distortion and splatter on today's crowded bands. Thus, one should equalize the microphone first, then process it if necessary.

We also tested the EQ-200 equalizer with the Pro Com 200 headset and a Drake microphone, which had the original Astatic element removed and replaced with a new Heil HC-3 "key element," which is a specially tailored element for amateur communication. The HC-3 and the EQ-200 equalizer combination produced studio-quality audio.

To be sure, the equalization of a microphone is not in the same category as a 2-kW amp or a 150-foot tower, but the audio must be right for those items to be most effective. The additional clarity provided by the higher quality Heil audio made my venture into the North American SSB Sprint very successful. Even in that fast-moving contest, three contestants stopped long enough to mention that I had excellent audio!

Denny Burgess K8DB

Michael R. Meltzer K2SDD
121 Clearview Road
DeWitt NY 13214

This Pileup's For *You!*

You don't have to fly to the ends of the earth to have a popular signal. Here are three tricks to bring the screaming hordes onto your frequency.

Number 6 on your Feedback card

Have you ever felt envious listening to a DX station that was underneath a gigantic pileup? The popularity must be great fun—with so many people yelling and screaming into their microphones or pressing their CW keys right through the table top. Would you like to experience the fun of having the guys (and gals) standing in line just to work you, too? Well, it can happen, and you do not have to go on an expedition to a coral reef or a northern iceberg—it's easier than you think.

You do need at least an average signal for the techniques I am going to describe. Even a real DX prize cannot create a pileup if no one can hear him. So let us assume you have a few hundred Watts and a good antenna. If you're willing to answer lots of QSLs, you're ready to go.

Take Off

Go where? My first suggestion is to go on a little DXpedition to Vermont, Delaware, or Wyoming. These states contain only around 800 licensed hams each, which is much less than most DX countries. Even Hawaii has twice as many. Because we live only a few hundred miles from them, we may not realize how much in demand these little states are to our brothers in Europe and Asia. Go there and put out a reasonable signal on 10, 15, or 20 meters and watch what happens. They will crawl all over each other to work you and get a QSL card.

Novice DX

If you cannot leave your home QTH, there are other ways to attract a crowd. Many European countries and Japan offer Novice-type licenses with power limits of only 10 Watts or less. If you are running 200 Watts and you have a hot enough receiver so you can hear them, they will hear you for sure and you will have a 13-dB advantage that will attract them faster than you can work them. This works well on CW. I like 15 meters best. Be sure to keep your code speed down because these guys are beginners. And in case you haven't guessed, every single one of them will want QSLs from the DX states of New York, California, and Texas.

Be A Personality

My third suggestion for attracting a pileup is to become a special personality. King Hussein of Jordan attracted pileups on 2-meter repeaters when he visited California. Barry Goldwater is in such demand that he hires a staff to run his station. And Arthur Godfrey . . . well, what can I say? But if you cannot become a great politician or a king, what can you do?

"When he called CQ, he would add: 'No lids, no kids, no YLs, no XYLs, no bus drivers, no hitchhikers, no space cadets, no phonetics.' "

I'd like to describe some special personalities I have contacted and you will see. There was John King of the giant King Ranch in Texas who used to frequent 15-meter phone. John had a very powerful and very attractive Texas accent. When listening to his voice, you just knew that he was the fastest, straightest shot west of the Pecos.

John's voice and quick wit made him a real Pied Piper. He kept his QSOs very short, so no one could get to know him too well, and this added an air of mystery to the "stranger from Texas." As soon as he said "so long" to his contact, the frequency would explode with callers. If you practice your Texas accent for a few weeks and develop a handful of original phrases, you will be ready to take over where John King left off.

As for me, I have always found that the voice and personality of my friend Damon WB2PEL strongly attracts my attention. Damon can do "a John King" without even trying. But the rest of us may need a little practice first. While you are at it, why not become proficient as John Wayne, Humphrey Bogart, or Peter Lorre? I have been told often that I sound like Dick Cavett, but that has yet to create pileups around my signal. Most people just tell me I sound familiar, but they are not sure why.

Back in the 1950s, I encountered the most famous personality of 75-meter phone in the East. He was W2OY from Lancaster, New York, "the man we loved to hate." Mike would make a practice of being the most critical and grouchiest stinker on the band. He was *mean!* When he called CQ, he would add: "No lids, no kids, no YLs, no XYLs, no bus drivers, no hitchhikers, no space cadets, no phonetics." He was *rotten!*

When he was in QSO, the lids would swish their vfos back and forth to QRM him. The "kids" even recorded his signal and replayed it outside of the band. He was *hated!* But he got a lot of attention and a lot of QSOs. The first time I talked to him, he criticized me strongly for asking, "How do you copy?" "You only *copy* CW," he told me.

After a few more contacts with Mike, I began to suspect something. And when I met him at the Rochester Hamfest, it was confirmed: It was all a big put-on. W2OY was one of the nicest guys you would ever want to meet. But over the air, his many friends never let on. We were saddened to learn of his death which was caused by a heart attack while he was up on his tower many years ago. Who will be the next W2OY? Perhaps it could be you.

So you see, if you want popularity on the ham bands, there are many tricks that work. Tell them you are using solar power. Tell them you are trying to break the Guinness record for QSOs while standing on your head. Tell them you are Jimmy Cagney or Boris Karloff. But don't use Dick Cavett—that one is mine. ■

C. Steer WA3IAC
7148 Montague Street
Philadelphia PA 19135

Narrow-Minded Filtering

Spend fifteen minutes tinkering with this switched-cap filter for CW: You'll wonder where all of those signals came from!

Number 7 on your Feedback card

Did you ever find yourself in need of a good CW filter? Not just one with a narrow passband at −3 dB, but one with a narrow passband at −40 dB? Well, read on.

The filter I'm talking about has a passband of about 300 Hz, doesn't take up much room, can be run off 9-volt batteries (it takes two), and uses a new approach to the old active filter. One other thing: There are only two chips in this project. One is the RF-5614 filter, the other is a waveform generator.

Now for the filter. The RF-5614 is a monolithic switched-capacitor bandpass filter packaged in an eight-pin mini-DIP. The IC contains a six-pole Chebyshev ANSI class-II bandpass filter using an external-input clock trigger. The center frequency of the filter is tunable by the clock frequency. The distortion can be less than 0.1% with a dynamic range better than 86 dB. The filter will handle input signals of greater than 17 volts p-p with an insertion loss of less than ±0.2 dB.

Some other features are that it is small, it requires no other external components, and the power-supply range may be ±5 volts to ±10 volts. (I used two 9-volt batteries.) The corner frequency range is from 10 Hz to 25 kHz.

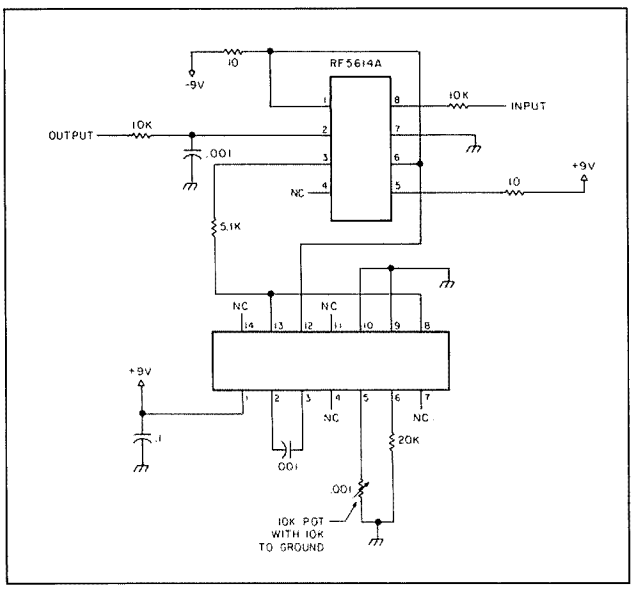


Fig. 1. Schematic of the CW filter.

Operation

The bandpass filter is self-contained and requires only an external clock trigger and a plus and minus power supply. Because the clock trigger sets the control frequency of the passband and also the sampling rate (27 times the control frequency), I will address this first.

As with any sampled data system, signals above half the sampling frequency will be aliased and may appear in the band of interest. If signals greater than 13.5 times the control frequency will be applied to the filter, an external anti-aliasing filter may be required. I found this to be true (as can be seen in the low-pass RC filter on the output in Fig. 1). In applications where the clock residue may affect system performance, a single-pole filter should be added to the filter output.

The trigger-clock frequency is twice the sample rate, or 54 times the center frequency. For a 1-kHz center frequency, the clock must be 54 kHz. The input clock is divided by two in generating the on-chip clock waveform that controls the sampling rate.

One note before moving on: This device is a MOS device and handling precautions

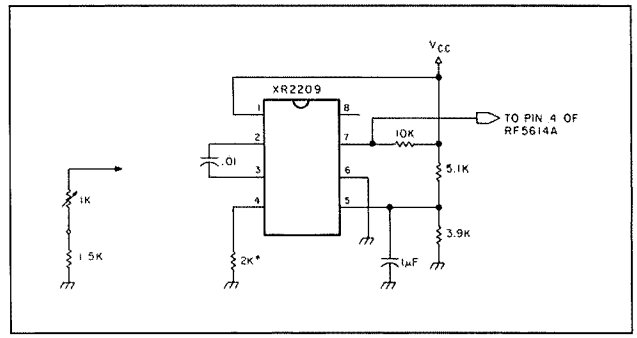


Fig. 2. An alternate clock circuit using the XR-2209. Replacing the 2k-Ohm resistor on pin 4 with the 1.5k/1k pot combination lets you adjust the center frequency from about 790–1320 Hz.

should be used. Don't apply instantaneous supply voltage to the device or insert or remove the device from its socket while it's on. Decoupling networks were added for turn-on/turn-off switching transients and ripple. (There's no ripple with batteries, but I may want to add a dc supply later.)

Trigger Clock

For the trigger-clock, I used an XR-2207 voltage-controlled oscillator chip. The XR-2209 could also be used, but the pinouts are not the same. The power supply can be up to 26 volts from a single or split 12-volt power supply.

Inside the XR-2207 are four main functional blocks for frequency generation: a voltage-controlled oscillator, current switches that are activated by binary-keying inputs, and two buffer amplifiers for triangle- and square-wave outputs. The vco is actually a current-controller oscillator which gets its input from the current switches.

As the output frequency is proportional to the input current, the vco produces four discrete output frequencies. Two binary-input pins determine which timing currents are channeled to the vco. These currents are set by resistors to ground from each of the four timing terminals—pins 4, 5, 6, and 7.

Using the XR-2209

The circuit shown in Fig. 2 will produce an output frequency of 54.21 kHz which, when divided down inside the filter, will give a center frequency of 1.003 kHz (54.21 divided by 54). The center frequency could be set lower or higher by replacing the 2k resistor with a 2.5k, 10-turn pot. Using a 2.4k fixed resistor, the output frequency will be 43.1 kHz, giving a center frequency of 798 Hz.

When using a split power supply, pin 6 has the negative voltage and pin 5 is grounded. A 0.1-nF capacitor should be placed between pins 6 and 5. All other parts stay the same. This description is for the XR-2209 only and not for the XR-2207. For the square-wave output (pin 13), the device is an open collector and is pulled up with a 4.7k resistor.

Parts List

2	10 Ohm, 1/4 W	RS 271-1301
3	1k Ohm, 1/4 W	RS 271-1335
1	5.1k Ohm, 1/4 W	Mouser PN 30BJ250 5.1k
1	4.7k Ohm, 1/4 W	RS 271-1330
1	20k Ohm, 1/4 W	Mouser PN 30B5250 20k
1	10k pot	RS 271-1721
1	.001-nF, 50-V capacitor	RS 272-126
2	.1-nF, 50-V capacitors	RS 272-135
1	FR 5614-A	EG & G Reticon
1	XR-2207	EXAR Corp.
1	Aluminum utility case	RS 270-286
1	Experimenter's IC board	RS 276-161

1. Radio Shack.
2. Mouser Electronics, 2401 Highway 27 North, Mansfield TX 76063.
3. EG & G Reticon, 345 Potero Avenue, Sunnyvale CA 94086.
4. EXAR Corp., 750 Palomar Avenue, Sunnyvale CA 94086.

To the Pileups!

Now that you know how each device works, you can put them together to make a nice filter with a passband of about 300 Hz from the −3-dB points. Layout is not critical. I used a piece of 1" x 4-1/8" experimenter's IC board from Radio Shack (# 276-161) and put the filter into a utility case.

I think that you'll enjoy building and using this little filter. See you in the pileups on 20! ■

MERRY CHRISTMAS FROM DAN, SANDI, LAURA, RICK, MARK, BRIAN, FRENCHY AND RUSS

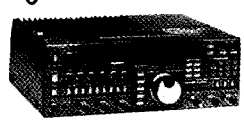
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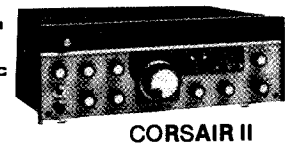


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1987 WORLD SSB CHAMPIONSHIPS

Announcing the January Classics—the 1987 running of the World SSB Championships! The first and only contests of their kind, these six individual single-band events are world-renowned and amongst the most challenging events on the bands today. Winners of each contest determine the World Champion for 10-, 15-, 20-, 40-, 75-, and 160-meter single sideband:

0000 UTC January 3, 1987
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1st 10-Meter World SSB Championship

January 10, 1987
0000–2400 UTC
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January 11, 1987
0000–2400 UTC
3rd 20-Meter World SSB Championship

0000 UTC January 17, 1987
through 2400 UTC January 18, 1987
8th 160-Meter World SSB Championship

January 24, 1987
0000–2400 UTC
6th 40-Meter World SSB Championship

January 25, 1987
0000–2400 UTC
8th 75-Meter World SSB Championship

MISC. RULES:

Stations may be worked only *once per event*. All contacts must be two-way SSB transmissions. All stations, regardless of their operating class, may operate entire contest periods without a rest period.

OPERATOR CLASS:

(a) Single operator, single transmitter, SSB only. (b) Multi-operator, single transmitter, SSB only.

EXCHANGE:

Stations within the continental 48 U.S. states and 13 Canadian provinces or territories transmit RS report and state, province, or territory. All others, including Alaska and Hawaii, transmit RS report and DX country.

QSO POINTS:

5 QSO points for contact within your own continent, 10 QSO points for contact outside your own continent.

MULTIPLIER:

1 multiplier point is earned for each continental U.S. state (48 max.), Canadian province or territory (13 max.), or ARRL DXCC country (excluding the United States or Canada).

DX WINDOW:

For the purpose of this event, DX window frequencies are reserved for *split-frequency operation only*. W/VE stations are not to transmit in the DX window. DX stations may transmit in the DX window but *must* receive *outside* window frequencies. DX Windows: 7.080–7.090; 3.790–3.805; 1.825–1.830; 1.850–1.855, and 1.907–1.913 MHz.

FINAL SCORE:

Total QSO points x multiplier points = claimed score.

CONTEST ENTRIES:

Entries must include (1) a contest log, (2) a dupe sheet for 100 or more contacts, (3) a list of multipliers, and (4) a summary sheet as outlined below. Be sure to include your soapbox comments and a black-and-white photo for possible publication.

SUMMARY SHEET:

Summary Sheets must contain (1) contest callsign, (2) your QTH, (3) station owner's name and address, (4) a list of station equipment and antennas, (5) operator class, (6) total QSO points, (7) total U.S. states worked, (8) Canadian provinces and territories worked, (9) the total of ARRL DXCC countries worked, (10) total multiplier points, (11) claimed score, and (12) if a multi-operator station, a list of participants, by callsign.

ENTRY DEADLINE:

Mail contest entries separately to the contest chairman listed below. Entries must be *postmarked no later than February 18, 1987*. Late entries will be registered as check logs.

DISQUALIFICATION:

Contestants may be disqualified if they run illegal power, cause deliberate interference, fail to comply with the DX window rules, attempt to achieve a scoring advantage, or if the number of duplicate contacts not cancelled exceeds more than 3% of the total contacts made. Contest committee decisions are final.

PENALTIES:

A penalty of 100 QSO points will be assessed for *each* duplicate contact counted in a contestant's claimed score.

AWARDS:

A minimum of 100 QSOs must be worked in an event to be eligible for certificates. Plaques will be issued to World Championship stations who work a minimum of 500 contacts. Awards will be issued in each operator class, in each continental U.S. state, Canadian province and territory, and ARRL DXCC country represented.

Overall Winners—Single Op:

USA	WB9HAD	86	539,250
Canada	VE3CDX	84	318,150
DX	I4OUT	85	188,415

Overall Winners—Multi-Op:

USA	KM5X	86	585,945
Canada	VE2CAR	83	61,380
DX	LZ2CJ	84	142,080

W/VE Stations—Single Op:

AL	KX4X	84	195,900
AR	WA5NFC	88	126,990
AZ	WB7FDO	82	71,285
CA	K6SE	83	191,750
CO	K0RF	84	309,760
CT	W1ODY	85	228,690
DE	AA1K/3	83	266,660
FL	K4AQQ	83	173,800
GA	W4VKK	82	106,020
IA	W0EJ	85	401,580
ID	KA7T	85	21,250
IL	WB9HAD	86	539,250
IN	W9RE	82	371,580
KS	N7DF/0	84	344,850
KY	N4ICS	85	76,055
LA	WB5WAK	85	18,725
MA	W1CF	82	236,280
MD	W3YOZ	88	417,730
ME	KA1PE	83	95,975
MI	KC8P	84	331,695
MN	W0HW	82	60,435
MO	KC0QO	85	5,940
MS	N5GDO	85	68,160
MT	K7VIC	84	231,570
NC	W4TMR	86	246,300
NE	K0HA	84	309,070
NH	W1RR	84	302,400
NJ	W2FCR	84	222,300
NM	W5YZ	82	92,950
NV	KA7BRE	84	87,480
NY	WA2SPL	84	490,985
OH	KC8JH	84	337,050
OK	N5CG	83	165,135
OR	WB7OZM	82	32,980
PA	W3TS	86	231,660
RI	KA1SR	85	133,650
SC	N4LTA	86	88,510
SD	K0STI	83	132,000
TN	KC4OV	82	130,140
TX	N5JB	83	180,600
UT	N7DF	82	103,880
VA	WD4KXB	85	211,575
VT	WB1GQR	85	139,690
WA	W7AWA	85	104,550
WI	WA1UJU	86	197,800
WV	W8LRL	82	350,700
WY	W7FT	83	50,500
ALT	VE6OU	82	19,995
BC	VE7CRU	83	76,755
MAN	VE4WR	82	43,120
NB	VE1BRA	84	18,850
NS	VE1YX	63	69,720
ONT	VE3CDX	84	318,150
PEI	VE1BPY	84	22,050
QUE	VE2ZP	82	75,900
SASK	VE5RA	86	146,160
YUK	VY1CW	86	1,860

W/VE Stations—Multi-Op:

CA	N4ARO/6	84	31,980
CO	KB0TJ	83	175,200
DE	AA1K/3	82	75,525
FL	WA4JXI	85	250,995
IL	K9YUG	82	152,400
IN	K9ZUH	82	213,280
KS	W0CEM	86	453,590
KY	W4SEL	86	371,515
MI	W8RA	86	364,000
MN	W0SW	84	63,640
NJ	WV2ZOW	86	64,500
NY	WA2SPL	83	325,230
OH	WB8IFP	86	584,825
OR	NK7U	85	207,675
PA	KC1U	86	475,475
RI	WA1ZEB	83	75,670
TN	N4FNB	86	200,760
TX	KM5X	86	585,945
VA	NZ4B	83	65,280
VT	WB1GMG	83	81,740
WA	K7LXC	85	82,080
WI	WB9SLR	84	137,535
QUE	VE2CAR	83	61,380

DX Stations—Single Op:

Alaska	KL7XO	84	1,740
Andorra	C31OF	85	30,100
Argentina	LU9EIE	83	5
Austria	OE1DH	86	22,185
Balearic	EA6ET	82	5,130
Barbados	8P6KX	82	1,490
Bermuda	VP9BO	82	51,200
Bulgaria	LZ1KOZ	85	20,105
Cayman Is.	ZF2DX	82	21,150
Czech.	OK3CZM	86	39,780
England	G3XTT	84	25,560
Germany (E.)	Y24AK	86	1,050
Germany (W.)	DL7MAE	86	12,360
Hawaii	KH6IJ	82	2,175
Italy	I4OUT	85	168,415
Ireland	EI4DW	84	8,820
Mexico	XE2NNZ	86	11,610
Poland	SP5INA	84	35,650
Portugal	CT1AFN	86	4,250
Spain	EA3CCN	85	72,580
UN HQ	4U1UN	85	25,625
Venezuela	YV2IF	85	109,800

DX Stations—Multi-Op:

Bulgaria	LZ2CJ	84	142,060
England	G6HH	85	25,680
Germany (W.)	DF5ZD	82	3,135
Yugoslavia	YU7JDE	83	3,680

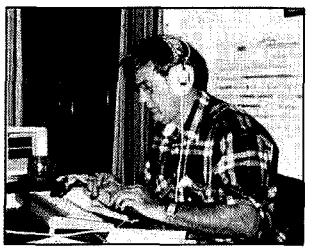
Table 1. 160-meter all-time record holders. (Columns show QTH, callsign, year, and score.)



WB9HAD, the 160-meter single-op champion.



The ops at WØCEM "steak" their claim to a fourth place 160-meter multi-op finish. From left to right: ABØS, KØWA, WAØTKJ, and WØCEM.



W4SEL says that dupe checking over 1,000 160-meter QSOs is the pits.

160-METER WORLD SSB CHAMPIONSHIP CONTEST

Callsign, QTH, QSOs, states and provinces, DX countries, total score
** = World Champions; * = State, Provincial, Country Champions

**	WB9HAD	IL	1,431	59	16	539,250
*	W3YOZ	MD	1,106	56	18	417,430
	K3ZO	MD	1,030	61	19	405,990
*	KC8P	MI	1,050	56	7	322,385
*	VE3NNR	ONT	897	56	13	315,350
*	W4TMR	NC	887	53	7	246,300
*	K7VIC	MT	743	57	4	246,300
*	W3TS	PA	722	—	—	231,680
*	K2RIH	NY	570	55	20	221,250
*	W2FCR	NJ	581	—	—	219,365
*	WØEJ	IA	701	54	5	208,270
*	WA1UJU	WI	776	51	0	197,880
	W3BGN	PA	563	—	—	195,500
*	K6HNZ	CA	565	54	11	187,525
*	VE5RA	SASK	463	55	8	146,160
*	ADØJ	CO	444	54	6	136,335
*	WA5NFC	AR	498	49	2	126,990
*	KA1SR	RI	313	51	17	110,840
	NF4C	NC	377	44	9	102,290
*	K7QQ	WA	340	54	4	99,180
*	N4LTA	SC	334	53	0	88,510
	KF4HK	NC	261	56	11	87,040
	KA8T	MI	389	43	1	86,020
*	KK9G	IN	365	41	2	78,475
*	N8ET	OH	299	49	1	74,750
*	KVØI	NE	296	60	0	74,000
*	W4UWC	TN	274	50	3	72,610
*	N7FMB	VA	328	41	3	72,160
*	KE5WO	MS	291	49	0	71,295
	N3EHD	MD	264	50	3	70,498
	W9MQZ	WI	313	50	1	69,815
*	VE4JB	MAN	257	50	2	66,300
	W7AWA	WA	275	47	1	66,240
	K2FL	NJ	233	45	9	63,990
	VE4WR	MAN	205	52	2	55,890
	W1MX (KA1SA op)	MA	220	41	6	51,935
	N4HQT	TN	258	35	2	48,100
	K8SVT	OH	214	44	0	47,080
	N4BSN	TN	169	50	4	46,440
	KA2CDJ	NC	199	43	5	45,770
*	KD5VU	TX	163	48	7	44,825
*	KI4M	AL	180	45	3	43,440
	NØAKC	WI	181	48	2	42,250
	VE3OZ	ONT	212	35	2	39,590
*	VE2DTI	QUE	176	41	3	39,280
*	K8HVT	CT	156	39	6	35,550
*	KI4UJ	KY	161	44	0	35,420
	KC2KK	NY	191	36	0	34,380
	W4KMS	VA	135	45	0	31,275
*	W4WKQ	FL	134	40	2	28,140
	W2CVW	NJ	138	39	0	26,910
*	W8VEN	WV	132	39	1	26,400
	KG9D	IL	121	43	0	26,015
*	KA1SA	MA	126	37	3	25,400
	W4XT	KY	115	37	3	23,600
	N5AFV	TX	106	35	1	19,080
*	KB8KW/7	WY	100	35	1	18,180
	VE2QO	QUE	109	33	0	17,985
	W3ARK	PA	108	27	0	14,580
	VE3CWE	ONT	80	35	0	14,000
	VE1TE	NB	87	31	0	13,485
	KQ1F	MA	68	33	1	12,410
	W9RE	IN	71	33	0	11,715
	W4HVU	NC	61	25	2	8,505
	W3SOH	VT	65	22	0	7,150
	KW2J	NY	55	24	0	6,600
	N9KS	WI	44	25	0	6,500
	K5GN	TX	47	22	1	6,240
	WA6FGV	CA	77	14	1	5,850
	N8CUX	OH	39	20	1	4,095
	K7LXC	WA	31	15	0	2,325
	VY1CW	YUK	31	12	0	1,860
	W4UXC	GA	21	17	0	1,785
	NF2C	NJ	19	12	0	1,140
	WA5KBH	LA	17	10	0	850
	VE3IHB	ONT	11	8	0	440

(The following stations cited total multipliers and failed to distinguish between W/VE and DX: W3TS—64 total multipliers, W2FCR—73 total multipliers, W3BGN—68 total multipliers.)

DX—Single Operator:

**	EA3CCN	Spain	196	7	35	44,100
*	OK3CZM	Czech.	188	1	38	39,780
	OE2DH	Austria	121	0	27	22,815
	OK1JDX	Czech.	108	4	30	20,060
	OK1AJN	Czech.	120	1	30	18,600
*	DL7MAE	FRG	100	0	24	12,360
	OE3HCS	Austria	122	0	20	12,200
*	XE2NNZ	Mexico	129	18	0	11,610
	G3UEG	England	80	1	23	9,720
	I4CSP	Italy	66	0	24	7,870
	OK1DWC	Czech.	38	0	19	7,220
	EA1AW	Spain	62	0	17	5,440
	EA5AEN	Spain	47	0	19	4,665
	CT1AFN	Portugal	47	0	17	4,250
	EA5JC	Spain	43	0	18	4,050
	EA2BUF	Spain	48	0	16	3,925
	OK2SRA	Czech.	42	0	15	3,150
	OK3CRT	Czech.	16	0	11	1,760
	Y24AK	GDR	21	0	10	1,050
	Y64YG	GDR	18	0	7	630
	SP6DVP	Poland	13	0	8	520

W/VE—Multi-Operator:

**	KM5X	TX	1,313	58	29	585,945
*	WB8IFP	OH	1,522	—	—	584,825
*	KC1U	PA	1,210	56	21	475,475
*	WØCEM	KS	1,338	59	11	453,590
*	W4SEL	KY	1,097	56	11	371,515
*	W8RA	MI	1,138	56	8	364,000
*	NK7U	OR	800	57	9	264,990
*	KC5DX	TX	751	56	13	261,510
*	N4FNB	TN	710	48	8	200,760
*	WV2ZOW	NJ	430	27	3	64,500
*	WB6EGE	CA	165	33	5	31,540
*	KB8AC	IN	140	44	1	31,500

(WB8IFB did not cite W/VE and DX multipliers separately. He had a total of 77 multipliers.)

Multi-Operator Participants:

WV2ZOW	WV2ZOW, WB2TIX
N4FNB	N4FNB, KA4IEU, KB4LXS
W4SEL	W4SEL, KI4LE, W4WYX, KF4NB, KD4TQ
KC5DX	KC5DX, NN5E
KM5X	KM5X, N5RZ, K5ZD
NK7U	NK7U, NI7T
KB8AC	KB8AC, WD8LLR
WB8IFB	WB8IFB, KC8CP, N8EZM, WA2ZQW, WD8ROD
W8RA	W8RA, NF8CM, N8CXX
WØCEM	WØCEM, WAØTKJ, ABØS, KØWA

RULES AND FORMS:

Contestants are encouraged *to send an SASE* for official forms:

Bill Gosney KE7C, World Championship Contests, 2665 North Busby Road, Oak Harbor WA 98277, USA.

Mail each entry to the appropriate contest chairman:

10-Meter Contest Chairman
Linda Ingram KG6MO
44720 N. 11th Street East
Lancaster CA 93535

15-Meter Contest Chairman
Gary Vest NW5E
Star Route, Box 34
Holliday TX 76366

20-Meter Contest Chairman
Chuck Ingram WA6R
44720 N. 11th Street East
Lancaster CA 93535

40-Meter Contest Chairman
Dennis Younker NE6I
43261 6th Street East
Lancaster CA 93535

75-Meter Contest Chairman
Ron Johnson KC7PA
68 South 300 West
Brigham City UT 84302

160-Meter Contest Chairman
Bill Gosney KE7C
2665 N. Busby Road
Oak Harbor WA 98277

WB9HAD, KM5X, and EA3CCN —160-Meter World Champions—

The 1986 single-operator champion distanced the second-place finisher by more than 300 QSOs; the multi-op competition was a barn burner. Only 1,020 points separated *the* champion and his runner-up. *Truly* exciting!

WB9HAD became World Champion in the W/VE single-operator class with 1,431 QSOs, 59 states and provinces, and 16 DX countries on 160. His only challenge came from second-place finisher W3YOZ, who tallied 1,106 QSOs, 56 states and provinces, and 18 DX countries.

For single-op DX stations, our friend EA3CCN earned this year's championship with 196 QSOs, 7 states and provinces, and 35 DX countries. Considering poor European propagation both nights, this effort is to be commended. Hopefully, conditions will be better in '87.

KM5X made its mark in the multi-operator category. This world-championship station slipped past well-known contender WB8IFP by a margin of 1,020 contest points. The big difference was in multipliers. KM5X had 87 total multipliers compared to 77 for WB8IFP. Unfortunately for the runner-up, his higher-latitude location restricted his DX capabilities. [Now you know how we feel in the Northwest! *Hi!*]

Becoming a 160-Meter World Champion places you in a group of some notable Top Band operators. Let's review a bit of 160-meter history:

75-METER SOAPBOX

IK4CFV —Good-bye and good job! Please send rules for next year's contest.

KY1H —Good activity. Wish I could have stayed on 24 hours instead of only six.

KQ3V —I know I passed up several multipliers who were working "straight up" in the window. I think this is one of the best contests going.

KA7STQ—At the age of 15, it's hard to stay up all night after going to school all day Friday and running the 40-meter test, too!

KC7PA —I learned not to use a new rig for the first time during a contest.

KD0OZ —Have to put up an 80-meter antenna next time. Lots of fun!

KV0I —It's rough contesting when the line noise is running 10 over S-9. I was surprised I could do as well as I did.

VE5RA —Was able to work all 50 states and all 13 provinces and territories. [Super job, OM!—KE7C]

VE7AO —Enjoyed the contest very much. Was disappointed at some of the U.S. stations operating in the DX window. Looking forward to next year.

VY1CW —Severe geomagnetic disturbances for the preceeding weekend and strong aurora during the test. At 0600 UTC the band was practically dead.

WA5IYX—Quite a few big thrills; my first KL7, European, and African QSOs on 75 meters.

Single Op	W/VE	DX
1981	W8LRL	C6ADV
1982	W9RE	VP9BO
1983	KC8JH	YV3AZC
1984	WA2SPL	EA3CCN
1985	N7DF	LZ2CJ
1986	WB9HAD	EA3CCN

Multi-Op	W/VE	DX
1981	W4CN	ZF2DX
1982	W8NGO	—
1983	K8ND	YU7JDE
1984	K9ZUH	LZ2CJ
1985	WB8IFP	G6HH
1986	KM5X	—

Were there any world records broken? Of course there were! With Big Guns leading the pack, you expect a shoot-out, right? Here's how this year's efforts fit into the record book for 160-meter QSOs:

WB8IFP	1986	1,522
WB9HAD	1986	1,431
W0CEM	1986	1,338
KM5X	1986	1,313
KC1U	1986	1,210
N7DF	1985	1,177
W0EJ	1985	1,152
N7DF	1984	1,125
W8RA	1986	1,138
W9RE	1982	1,118

Single Op:				
NR5M	TX	TS-930S	Alpha 77D	2-element yagi; 3 half-wave slopers
K0HA	NE	TS-830S	HB 813s	6-element phased verticals
WB9HAD	IL	TS-930S	Alpha 374	Delta loop and beverages
N4KMY	NC	TS-430S	Clipperton	Quarter-wave slopers
N8CXX	MI	FT-102	SB-220	Inverted vee and vertical
Multi-Op:				
K3TUP	PA	TS-930S	Alpha 77D	4-element vertical, dipole
W8LT	OH	TS-830S	TL-922A	600' longwiro, bobtail
KS9O	IL	C-Line	SB-220	Delta loop, sloper
NK7U	OR	TS-930S	Alpha 78	Delta loop, vertical
KS3F	PA	TS-930S	Alpha 76	Inverted vee

Table 2. Antenna systems for the top-ten 75-meter stations.

Can you imagine 1,500 QSOs on 160? Now you see why our events are said to be the busiest going. There were more than 3,500 stations on the band, so you have to ask why WB8IFP didn't work the other 2,000? The obvious answer is that time ran out or he probably would have.

How did everyone else fare? Stations with 1,000 or more QSOs included: WB8IFP (1,522), WB9HAD (1,431), W0CEM (1,338), KM5X (1,313), KC1U (1,210), W8RA (1,138), W3YOZ (1,106), W4SEL (1,097), KC8P (1,050), and K3ZO (1,030).

On 160, multipliers are at a premium. Stations with 50 or more states and provinces to their credit included: K3ZO (61); KV0I (60); W0CEM and WB9HAD (59 each); KM5X (58); NK7U and K7VIC (57); KC1U, W4SEL, W8RA, KC5DX, KF4HK, W3YOZ, KC8P, and VE3NNR (56); K2RIH and VE5RA (55); W0EJ, K6HNZ, and K7OQ (54); W4MTR and N4LTA (53); VE3WR (52); WA1UJU and KA1SR (51); W4UWC, N3EHD, W9MQZ, VE4JB, and N4BSN (50).

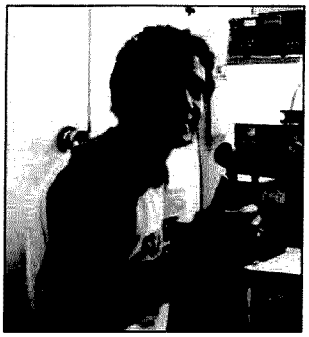
Stations capable of DX are usually the winners. Those working 10 or more DX countries included: KM5X (29); KC1U (21); K2RIH (20); K3ZO (19); W3YOZ (18); KA1SR (17); WB9HAD (16); KC5DX and VE3NNR (13); W0CEM, W4SEL, K6HNZ, and KF4HK (11).

Speaking of statistics, one of the highlights of the year is reviewing the 160-meter honor roll. This year we see some new records broken. Look at your state, province, or DX country. Do you recognize someone's call? Why not give him a run for his money in '87? Become a regional champion—earn your place on the 160 honor roll!

The 1986 contest found stations wall to wall on the band. Who will be the first to do 2,000 QSOs on 160? K1AR, how about you? Pssst, N2AA, are you anxious to try? Is 2,000 even possible?

Overall Winners—Single Op:			
USA	K4JPD	85	754,650
Canada	VE5RA	86	332,220
DX	NP4CC	85	288,090
Overall Winners—Multi-Op:			
USA	K3TUP	86	733,590
Canada	VE2ZP	82	42,307
DX	IK4CFV	86	336,565
W/VE Stations—Single Op:			
AL	KD4XR	82	10,912
AR	N7KA	84	121,320
AZ	KQ7Y	85	40,940
CA	NA6T	84	185,310
CO	AD0D	84	344,085
CT	W1WEF	86	220,800
DE	AC3T (KA3B)	86	60,480
FL	N4BAA	84	578,260
GA	K4JPD	85	754,650
IA	WB0NCR	83	37,332
IL	WB9HAD	86	430,400
IN	KB0C/9	85	96,050
KS	N7DF	85	596,505
KY	NA4D	84	114,900
LA	KA5VUU	86	122,200
MA	KA1XN	84	412,880
MD	K3ZO	86	170,000
ME	KN1M	84	76,850
MI	N8CXX	88	364,965
MN	KI0F	84	125,685
MO	K0CS	84	283,360
MS	AE5H	85	65,280
MT	KS7T	85	104,225
NC	N4KMY	86	396,900
ND	KI3V/0	84	161,280
NE	K0HA	86	434,350
NH	AK1A	85	239,910
NJ	N2NU	84	417,970
NM	W5TTE	84	58,395
NV	KD7SP	85	115,640
NY	KA2AEV	85	143,400
OH	KC8JH	64	273,275
OK	K2GKK/5	83	22,814
OR	KI7M	84	112,895
PA	KQ3V	86	307,380
RI	KA1SR	85	129,270
SC	K4ADI	84	78,750
TN	N4TG	85	164,430
TX	NR5M	86	594,500
UT	N7DF	82	57,642
VA	AA4UE	85	127,875
VT	KT1J	85	22,420
WA	K9JF/7	85	168,960
WI	WA1UJU	84	156,600
WV	NJ8N	86	115,130
WY	KB8KW/7	86	61,425
BC	VE7AV	86	247,160
LAB	VO2CW	83	1,320
MAN	VE4ALO	86	155,135
NB	VE1AJJ	82	10,146
NWT	VE8XO	84	2,070
NS	VE1BDT	85	43,780
ONT	VE3CYX	85	317,770
QUE	VE2YU	85	47,940
SASK	VE5RA	86	332,220
YUK	VY1CW	86	6,405
W/VE Stations—Multi-Op:			
AR	WA5VVT	85	181,760
CA	KG6MO	86	56,100
CO	KY0S	85	364,420
FL	N4BAA	82	36,480
ID	W7UQ	86	30,450
IL	KS9O	86	391,460
IN	N4FKF	84	95,175
KY	NO4R	85	369,375
LA	KD5RW	86	58,575
MA	AJ1E	84	21,033
MI	KM8U	84	220,852
MN	KD0OZ	88	79,560
MO	WB0TCF	84	4,366
NC	NW4B	84	259,600
NH	K1WW	84	380,730
NY	KF2X	84	25,488
OH	W8LT	85	530,380
OR	NK7U	88	333,640
PA	K3TUP	86	733,590
RI	KK1B	84	82,650
TN	N4JII	84	42,640
TX	K5MR	86	295,800
VA	NA4L	84	365,805
VT	WB1GMH	84	11,656
WI	W9WI	85	400,520
QUE	VE2ZP	82	42,387
DX Stations—Single Op:			
Alaska	KL7U	86	65,265
Australia	VK6DU	85	99,550
Bahamas	C6ADV	83	32,550
Barbados	8P6KX	82	4,452
Bulgaria	LZ1KOZ	85	1,210
Cayman Is.	ZF2DX	82	12,282
Czech.	OK1MSM	82	16,640
Denmark	OZ1DPW	86	2,175
Dom. Rep.	HI8GB	83	75,330
Equador	HC1OT	85	34,500
England	G5EBA	82	868
Finland	OH1RY	85	189,150
France	F8WE	83	1,794
Greenland	OX3ZM	82	10,810
Guam	KD7P/KH2	84	48,800
Honduras	HR1FC	85	31,200
Hungary	HA8IE	83	1,938
Italy	I3MAU	82	96,334
ITU/Geneva	4U1ITU	84	41,125
Japan	JF2DQJ	85	12,960
Monserratt	K3WGR/VP2M	85	94,855
Morocco	CN8CO	82	67,032
Netherlands	PA3AZM	82	360
New Zealand	ZL1BQD	84	137,625
Portugal	CT4NH	82	10,770
Puerto Rico	NP4CC	85	288,090
Romania	YO4BXX	82	369
Soloman	H44SH	82	5,568
Spain	EA3CCN	84	71,815
Sweden	SM4CAN	82	1,250
Venezuela	YV5BHW	86	212,055
W. Germany	DF9ZB	85	123,240
Yugoslavia	YU3PG	85	1,850
DX Stations—Multi-Op:			
Columbia	HK1SC	86	172,975
Czech.	OK3KFF	85	18,900
Italy	IK4CFV	86	336,565
Japan	JA2YKA	86	38,775

Table 3. 75-meter honor roll—all-time record holders. (Columns show QTH, callsign, year, and score, respectively.)



YV5BHW, the 75-meter single-op DX champion.



IK4CFV, the 75-meter multi-op DX champion.

NR5M, K3TUP, IK4CFV, and YV5BHW —75-Meter World Champions—

The dust has settled and the entries are in. George NR5M and John K3TUP are the undisputed World Champions for 75-meter phone. Attaining nearly 1,100 QSOs, their multiplier counts were their trump cards, each surpassing their second-place rivals by 17 DX countries! NR5M, a single-op station, earned 1,087 QSOs, 58 states and provinces, and 42 DX countries. K3TUP made 1,097 contacts, 59 states and provinces, and confirmed 55 DX countries. By the way, this is John's second 75-meter Championship in a row. He is also 3-time World Champion on 40 meters. Awesome! It's obvious who the competition is. Congratulations, fellas!

Gustavo YV5BHW took first place to become World Champion for single-operator DX stations. In the multi-operator category, IK4CFV dominated the band by outscoring second-place station HK1SC nearly two to one. You both did a great job. Hats off to these World Champions!

Did we see the world QSO record broken? No, not this time, but we did see a few slots in the top ten list changing hands from last year:

Single Op:

N7DF	1985	1,265
K4JPD	1985	1,153
NR5M	1986	1,087
N7DF	1984	1,076
WB9HAD	1986	1,053
K0HA	1986	985
N4BAA	1984	894
N0XA	1985	888
N4KMY	1986	822
N8CXX	1986	804

Multi-Op:

K3TUP	1985	1,180
W8LT	1985	1,120
K3TUP	1986	1,097
W9WI	1985	1,025
NO4R	1985	964
KY0S	1985	892
W8LT	1986	876
KS3F	1986	837
KS9O	1986	808
NK7U	1986	800

75-METER WORLD SSB CHAMPIONSHIP CONTEST

Callsign, OTH, QSOs, states and provinces, DX countries, total score
** = World Champions; * = State, Provincial, or DX Country Champions

W/VE—Single Operator:

**	NR5M	TX	1,087	58	42	594,500
*	K0HA	NE	985	60	25	434,350
*	WB9HAD	IL	1,053	58	22	430,400
*	N4KMY	NC	822	59	31	396,900
*	N8CXX	MI	804	60	27	364,965
*	VE5RA	SASK	760	61	23	332,220
*	KQ3V	PA	600	58	36	307,380
*	VE7AV	BC	653	57	17	247,160
*	W1WEF	CT	529	52	23	220,800
	KB3A	PA	472	56	21	192,885
	KC8P	MI	475	57	18	187,125
*	K3ZO	MD	352	52	28	170,000
	K8HVT	CT	415	56	18	159,840
*	VE4ALO	MAN	433	59	12	155,135
*	KN1M	ME	351	52	22	141,340
*	WA1UJU	WI	430	53	5	125,280
*	KA5VUU	LA	368	54	11	122,200
*	W4WKQ	FL	402	54	5	118,590
*	NJ8N	WV	409	47	9	115,136
*	K7LXC	WA	305	52	14	108,570
*	KY1H	MA	330	51	7	98,310
*	KA1SR	RI	237	50	11	75,335
*	WA6FGV	CA	245	52	5	71,535
*	KB8KW/7	WY	180	53	10	61,425
*	AC3T	DE	177	48	15	60,480
	(KA3B op)					
	W3ARK	PA	244	46	3	60,025
	W7STQ	WA	136	44	8	38,740
*	AI9X	NM	155	40	5	35,775
	VE7AO	BC	117	48	7	35,475
*	KA7STO	OR	156	39	1	31,200
	W8VEN	WV	114	43	9	30,940
	KD5SA	TX	124	44	3	29,845
	KF4HK	NC	106	38	11	25,970
	KF1B	CT	105	41	4	24,075
	K1SSN	CT	100	38	4	21,840
	(K1AME op)					
	WK4F	FL	96	38	6	21,780
	WA5IYX	TX	84	37	8	20,025
	K8KUH	MI	87	35	1	15,840
	K4GKV	GA	68	32	1	11,385
	W3RGX	MD	58	33	2	11,025
	W9REC	IL	60	35	1	10,980
	N5AFV	TX	60	32	0	9,600
	NC9F	IL	50	27	0	6,750
	VY1CW	YUK	61	19	2	6,405
	KA9LWL	IN	39	28	0	5,460
	K2SCU/5	TX	42	22	3	5,250
	W0NGB	MN	40	26	0	5,070
	WE6G	CA	33	16	2	2,640
	W3FQE	MD	7	5	0	175
	WA3JXW	PA	5	4	0	100

DX—Single Operator:

**	YV5BHW	Venezuela	320	49	8	212,055
*	KL7U	Alaska	204	43	14	65,265
	JH1DHI	Japan	50	15	7	10,780
	EA3BOX	Spain	50	6	17	7,705
	CT1TM	Portugal	21	10	7	3,060
	OZ1DPW	Denmark	25	3	12	2,175

W/VE—Multi-Operator:

**	K3TUP	PA	1,097	59	55	733,590
*	W8LT	OH	876	58	38	453,120
*	KS9O	IL	808	58	34	391,460
*	NK7U	OR	800	56	19	333,840
*	KS3F	PA	837	57	17	315,240
*	K5MR	TX	639	56	31	295,800
*	W4TMR	NC	354	52	10	111,290
*	KD0OZ	MN	305	51	1	79,560
*	KD5RW	LA	210	48	7	58,575
*	KG6MO	CA	198	49	6	56,100
*	W7UQ	ID	143	38	4	30,450

DX—Multi-Operator:

**	IK4CFV	Italy	520	43	40	336,565
*	HK1SC	Columbia	318	47	8	172,975
*	JA2YKA	Japan	121	14	19	38,775
	JA9YBA	Japan	49	8	11	9,120

(Checklogs—By request: EA3CTI, EA3PE, KJ4NC, OZ1DPW, VO1OP; checklogs—Late entries: 4Z4TR, AH6EK, DL6FBL, JA1YAG, JA7YCQ, K5GN, OH7EU.)

Multi-Operator Participants:

HK1SC	HK1JWH, HK1JXV
IK4CFV	I4JMY, I4YSS, IK4BPE, I4USC
JA2YKA	JF2DQJ, JG2MTC, JG2VTD, JG3OET
JA9YBA	JH7UJR, JA9VDA
K3TUP	K3TUP, KB8IZ, KJ3L, N3BJ, AI8S
K5MR	K5MR, N5RZ
KS3F	KS3F, WA3SPJ
KD5RW	?????
KG6MO	KG6MO, WA6R
KS9O	KS9O, NB9T, KA9DVY
KD0OZ	KD0OZ, KA0UPF
NK7U	NK7U, NI7T
W4TMR	W4TMR and XYL
W7UQ	WL7AFB, KA7KGF
W8LT	K3JT, NZ4K, KU8E, KD8NS

Speaking of records, gander at the 75-meter Honor Roll list. We saw some new calls breaking or establishing records. Gives you an incentive to turn out for next year's contest, doesn't it?

For a 24-hour contest, especially on 75-meters, can you imagine making all those contacts? Insomnia? Wonder how many stations slept through the day Sunday?

Stations with 500 contacts or more included: K3TUP (1,097), NR5M (1,087), WB9HAD (1,053), W8LT (876), KS3F (837), N4KMY (822), KS9O (808), N8CXX (804), NK7U (800), VE5RA (760), VE7AV (653), K5MR (639), KQ3V (600), W1WEF (529), and IK4CFV (520).

In the past, Canadian multipliers have been a holdout. This year all states and provinces (48 states and 13 provinces) were heard and worked on the band. Turning in totals of 50 or more W/VE multipliers were: VE5RA (61); K0HA and N8CXX (60); K3TUP, N4KMY, and VE4ALO (59); NR5M, W8LT, KS9O, WB9HAD, and KQ3V (58); KS3F, VE7AV, and KC8P (57); NK7U, K5MR, KB3A, and K8HVT (56); KA5VUU and W4WKQ (54); WA1UJU and KB8KW/7 (53); W4TMR, W1WEF, K3ZO, KN1M, K7LXC, and WA6FGV (52); KD0OZ and KY1H (51); KA1SR (50).

The DX country count was very good for 75! Of course, the East Coast stations had a sizable turnout of European stations while the West Coast had very slim pickings from Asia and the South Pacific. Stations achieving 25 or more DX countries include: K3TUP (55), NR5M (42), IK4CFV (40), W8LT (38), KS9O (34), K5MR (31), K3ZO (28), N8CXX (27), and K0HA (25). On the West Coast, NK7U had the most DX countries worked with 19, followed by VE7AV with 17; K7LXC and KL7U confirmed 14.

75 meters and 160 are the two bands most vulnerable to high noise levels. Being able to receive a station is much tougher than trying to be heard. The hunk of wire you put up, its height above ground, the direction it is strung; with verticals, how it is fed, how it is cut (wavelength), whether it has radials or not, all are determining factors that must be considered if you expect to be a championship station on this band. So what attempts are made by our participants? From the results, here's what the breakdown looks like, showing the antennas used in the 75-meter contest and their percentages:

Inverted vee/dipole	40.0
Vertical	16.3
Quarter-wave sloper	8.7
Delta loop	7.6
Phased verticals	6.2
Inverted "L"	5.0
Half-wave sloper	5.0
Longwire	3.7
Wire beam	2.5
Bobtail curtain	2.0
Zepp	1.2
2-element yagi	1.0
3-element yagi	.8

Table 2 takes you a step further and shows you how all these statistics equate to what the top-ten stations were actually using on the air.

As we get ready for the 1987 contest season, all stations are reminded to observe the DX window from 3.790 to 3.805. For contest purposes, *the contest rules state that the DX window is for split-frequency operation only!* This means DX stations will only transmit and W/VE stations will only listen in the DX window. Two-way exchanges within the window, regardless of whether you are DX or W/VE, will result in your entry being disqualified. Unfortunately, this year a few stations were victims of this stipulation. We regret this action, but the integrity of our Championship events requires we not deviate one iota from the rules. Using the DX window as it was intended will mean more DX for us all!

Ron Johnson KC7PA, our 75-meter Contest Chairman, and I thank you for your participation. The season has been exciting. Congratulations to our state, provincial, and DX country winners. See you all this coming January.■

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OUR CHRISTMAS STORY

Sometimes a writer must search long and hard for a story to fit the holiday season. The easy way out is to simply report on all the new gear to be found "under the tree." That is, if your Christmas tree happens to be over the operating position in your ham shack. But, there is a lot more to the holiday season than a new hand-held or an HF transceiver. The holiday season is really a time for a new beginning. At least it's been that way in my life, and I'll bet it's been that way for many of you as well. So, keeping this concept in mind, I began searching for something apropos. As it happened, the material I was looking for had been right under my very nose since late last summer. It comes from the well-respected Southeastern Repeater Association's *Repeater Journal*, and was originally authored by Wayne C. Williams K4MOB. I have taken some slight liberties in revising the text to fit the national/international format of *73*, but I hope that you will feel as moved when you read it as I did. Here now is *73* Magazine's "Christmas Story."

A Portrait of Petie

The Sunday morning Radford, Virginia, *News-Journal* had the big headline: "PETIE AWAKE—SMILING AND WANTING A COKE." For those who had been following the life drama of Michelle "Petie" Lineberry, this was wonderful news.

Petie had just received a new heart from an unidentified Dallas, Texas, donor. The transplant operation had begun at 6:15 a.m. on Friday, June 13. Now, on Sunday, she was doing "very well" in the cardiac intensive care unit at the Medical College of Virginia.

Petie is the 20-year-old daughter of Bill Lineberry WB4TGT of Radford. Her problems began about two years ago when she visited the doctor because of a stubborn chest cold. They found a murmur in her heart. A year later, another visit determined that her heart was beating in an erratic pattern and fluid was building up in her lungs. At the Medical College of Virginia, they found that one side of her heart was completely dead. The muscles were not pumping, just wiggling.

Despite this, Petie went back to Radford University and maintained a B average, finishing the spring semester. Her condition continued to deteriorate, and she was admitted to the hospital in Radford, and then transferred to MCV. The prognosis: Petie needed a new heart. The search for a suitable donor started.

In June the donor was found; Petie received her new heart and is still recovering nicely. But, her troubles are not over. For the rest of her life, Michelle will be saddled with a $1,200-per-month anti-rejection medication bill. Unfortunately, WB4TGT had been laid off by AT&T just prior to Petie's operation, and hospitalization insurance was lost. Bills from the operation have exceeded $100,000 and, as already noted, will continue to build at a clip of $1,200 a month.

To try to help Petie and her family cope with these monumental expenses, a committee was established by interested friends in Radford. It's called the "Chance for Life Committee," and it has been conducting all sorts of fundraising events in the town to help out. Due to the enormous amount of money that needs to be collected, help is being sought from every possible source.

Enter Ham Radio

Bob Cecil WA4LNT has now started a campaign through amateur radio to help out his friend and fellow amateur WB4TGT and Petie. He asks that any or all hams nationwide who would like to help out to contact him. In addition, donations can be sent to Bob and he will forward them to the "Chance for Life Committee" on behalf of the amateur radio service. Clubs, repeater groups, and hamfest chairmen are also urged to find ways to join this drive to collect funds for this worthy cause.

In preparing this holiday column, I called Bob on October 11 to get an update on how Petie and her dad were doing. In one of those truly rare quirks of fate, at the time the phone rang at Bob's house, he was on the air and in QSO with Bill Lineberry WB4TGT. Only a few moments earlier, Bob had spoken with Petie and had learned that the doctors handling her case were amazed at the recovery. Right now, those very expensive anti-rejection drugs are doing their intended job and as a result, Petie is not only back in school, but she is also into a teaching work program where she holds classes twice a week—one day on the University campus and another at an outside grade school. She is majoring in child psychology, and doing quite well with her studies.

There has been some good news about her dad as well. Bill has found employment with an automobile dealership, and things are looking up a bit for the family. But, there are still the medical bills—the $1,200 a month for anti-rejection medication that will be with Petie for the rest of her life.

"The $1,200 a month for anti-rejection medication will be with Petie for the rest of her life."

As I write this, a thought occurs to me. There are currently about 450,000 licensed amateurs in the United States. If each one of us gave Petie's "Chance for Life Committee" a one-dollar donation, that would bring in close to a half-million. It could also mean that Petie need never again worry about the costs related to her illness.

Heart disease is a very expensive illness to suffer from. I know this firsthand, since I too am afflicted by it. Less than two years ago, I was a candidate for bypass surgery, but a new miracle drug has at least temporarily brought my problem under control. Obviously, I am far luckier than Michelle "Petie" Lineberry, but I too pay a high price—both financially and psychologically.

So, how about it, guys and gals? We pride ourselves on our dedication to public service. What better service can we hams collectively perform than to help to insure a life? How about we amateurs putting our monies where our mouths usually are, and collectively adopting Petie and her problems as a symbol of the one-on-one public service aspect of what ham radio is really all about? My few bucks are already in the mail. How about yours? Donations should be sent to the "Chance for Life Committee," c/o Bob Cecil WA4LNT, New River Valley Amateur Radio Club, Inc., Drawer 1127, Dublin VA 24084. No pun intended, but this is a topic that is personally very close to my heart.

HAM RADIO GIFT TAPES

I cannot close this month's column without making reference to one of the few tangible holiday gifts "that keeps on giving." Videotapes. You do not have to be a ham to enjoy them, but you do need to own a VCR. Beta or VHS. First, a presentation from one of the major studios. More accurately, you might say that it's a gift from a ham radio operator to the world, although you will have to pay to get a copy. The ham I am writing about is Jean Shepherd K2ORS. I first met Jean when he was still doing his late-night talk program on WOR radio in New York. Unlike the phone-in programs of today, "Shep" relied on his own abilities as an "observer of our times" to keep an audience "glued to its Emerson" for hours. Jean is the only radio host I know of who could make you enjoy listening to a commercial! After his WOR show, he could be found driving home and chatting with our "gang" on the old WA2SUR repeater.

In the 1970s, K2ORS hosted a little-known ARRL "video" titled "OSCAR And The Ham." I am still unsure of who produced and directed it, but it did explain the ways in which the second generation of OSCAR satellites could be used as an educational tool. Why the ARRL never exploited it the way they did films like "Hams' Wide World" or "Moving Up To Amateur Radio" is something I'll never understand. Maybe it was because "OSCAR And The Ham" was done on the then-new medium of videotape, and tape was something with which the ARRL was unfamiliar.

Jean has also been the featured banquet speaker three times at the Dayton Hamvention, and in 1985 I was able to corner him to record some public-service spots about ham radio. We did them on videotape, but at the time we had no way of knowing that the camera had malfunctioned. Since the audio was unaffected, they were

converted to radio spots by Lenore Jensen W6NAZ and sent off to ARRL HQ for distribution.

Anyhow, a few years back, Jean grabbed a jet out here to Hollywood, and with the folks at MGM/United Artists, he created the modern "Christmas Folk-tale." It has the simple but very apropos title of "A Christmas Story" and is based on his earlier best-selling book titled *In God We Trust—All Others Pay Cash.* If you have seen the film, then you already know what I mean. If not, go out and treat the family to something very special. It's a tape you will want in your collection, and an experience that will last a lifetime. Try any good video store to purchase a copy.

Another tape that you might want to have in your collection is "SAREX—The Shuttle Amateur Radio Experiment." Not because it tells the story of manned ham radio and ham TV in space, but rather as a lasting tribute to a truly valiant space machine that was known as the *Challenger*. The second amateur radio space operation flew on the *Challenger* in July of 1985. *Challenger* had only one other successful launch—Flight 61-A—before the accident that caused its destruction and the loss of its seven-person crew earlier this year. But the 61-A flight was never chronicled in as public and in-depth a way as was the "Ham in Space" 51-F mission. So, in essence, Roy Neal's ARRL video "SAREX—The Shuttle Amateur Radio Experiment" stands as a lasting and living testimonial to a truly proud space machine and to the many men and women who flew on her. You can purchase a copy on VHS for $25 from the ARRL, 225 Main Street, Newington CT 06111. They do not supply it in Beta format, but as one of its producers, I have a dub-master and will gladly fill any Beta II or Beta III orders as a not-for-profit service for the same price.

I wish you all the best of Seasons Greetings from those of us who write the late shift, here in the City of Angels.■

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WEATHERSAT

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Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
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VIDEO FORMATS

This month I am going to take a look at the basics of weather satellite video formats. One of the things that greatly simplifies the design of a weather satellite station is that all direct-broadcast satellites, be they polar orbiters or geostationary spacecraft, employ the same basic video modulation format. Although the rf modulation of these satellites is FM, the actual video signal transmitted in this fashion is an AM-modulated audio tone. The audio tone or subcarrier is typically 2,400 Hz or something very close to that value, a subject I will return to briefly at the end of this discussion. The modulation "sense" is such that minimum subcarrier amplitude corresponds to black, while maximum amplitude represents white.

Fig. 1 shows a diagram representing the detected and filtered subcarrier during one line of transmission of a hypothetical 16-step grayscale. The grayscale begins with black on the left and ends with white on the right side of the display. The white level (100% amplitude) is arbitrarily set at +5 V. Note that the black step is *not* 0 V (no subcarrier). With most spacecraft, assuming the modulator is operating properly (see discussion later), the black level will be about 4% of the peak white level or about 0.2 V with a +5-V peak white value.

The dynamic range of this signal, measured from 4% black to 100% white, is thus about 26 dB. This implies that the signal-to-noise ratio should be at least 26 dB, and preferably a little more, in order to have a "noise-free" video signal. As the amplitude of the noise increases relative to the video signal, the effect will first be noted as "snow" in the black end of the dynamic range. As noise levels increase, you will eventually reach a point where only the whitest portions of the image will peak above the noise threshold. There are two principal ways to increase the signal-to-noise ratio and lessen the impact of noise on your final display. The first involves optimizing the rf end of the system in several ways:

1) Maximizing antenna gain. Ignoring the negligible impact of solar and galactic noise, increasing the gain of the antenna provides basically "noise-free" gain.

2) Use of a low-noise front end.

3) Matching the i-f bandwidth to the signal bandwidth, a subject I discussed last time.

Assuming you have done everything possible at the rf end, some judicious audio filtering can be applied to reduce the impact of noise falling outside of the 2,400-Hz video passband. This is more complicated than simply putting a sharp 2,400-Hz bandpass filter in the video line because the AM-modulated 2,400-Hz tone has sidebands just like any AM signal and these must be passed in order to recover the video modulation with minimum distortion. Relatively low Q active filters, centered on 2,400 Hz with a bandwidth of about 1,600 Hz, work well in practice.

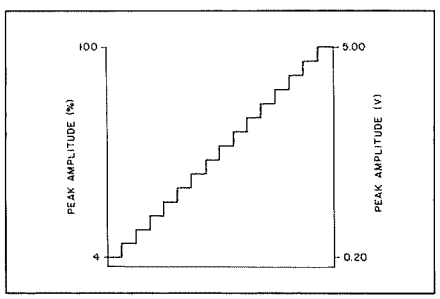


Fig. 1. Diagrammatic representation of a detected and filtered subcarrier signal modulated by a 16-step grayscale. The grayscale steps run from black on the extreme left to white on the extreme right. Output amplitude has been arbitrarily scaled to +5-V maximum. Note that while white represents maximum subcarrier amplitude (100% per 5 V), black, while minimum, does not go to zero. Black is normally about 4% of peak amplitude, corresponding to 0.2 V on the scale above.

Basic Signal Conditioning

Your basic weather satellite video system involves a video detector and post-detection filter to recover the modulated waveform in a form similar to that illustrated in Fig. 1. The filtered video output voltage is then used to control the display in one of three general ways:

1) Modulate the intensity of a CRT scanning beam in the case of a CRT (cathode ray tube monitor).

2) Control of the voltage on a printing stylus or the intensity of a glow modulator tube for facsimile printing.

3) A/D (analog-to-digital) conversion of the detected waveform for scan converter display.

Regardless of how we are going to use the video, it is obvious that an AM system of this sort is going to be amplitude sensitive. Any display system will require some sort of gain or contrast control so that the peak subcarrier amplitudes will reproduce as white while the minimum (4%) amplitude will come out black. Anything that changes the peak white amplitude in your system will result in a need to readjust such a control. Such readjustment can be tedious unless you use a scope to look at the video waveform, so we would like to minimize such peak amplitude variations as much as possible.

Unfortunately, there are lots of links in the system where such variation can occur. One of the more obvious sources, if you are recording pictures with tape, is variation in recording levels and audio output levels from your tape deck. This problem can be minimized by using a constant record and output level setting, preferably a combination that results in the same peak level that you would normally get directly from your receiver.

A second source of amplitude variation comes from the receiver in ways that are not inherently obvious. At this point, those of you who read my last column may be mumbling because I showed you how to install a constant output video tap from the top of the volume control. If we assume a constant gain from the rf, i-f, and audio stages, such a tap will always produce the same peak audio level at the output, given the *same* input signal. Unfortunately, even though the gain characteristics of your receiver may be quite stable, satellite input signals are rarely "the same," primarily due to differences in the deviation of the spacecraft transmitters.

Assuming your discriminator is reasonably linear, if your receiver will generate a peak output level of 1 V (a purely arbitrary value) with a fully modulated TIROS/NOAA signal deviating ±18 kHz, what do you think the results will be on a WEFAX geostationary signal that may be deviating ±10 kHz? The answer is about 0.55 V—10/18 x 1! If your display system is adjusted to display peak white with the NOAA signal, your WEFAX image "whites" will reach only mid-range gray values unless you increase the gain or contrast in the display system.

While any given type of polar-orbit spacecraft will usually be fairly similar in terms of signal deviation characteristics (similar, but not absolutely equal!), the peak signal levels recovered from the TIROS/NOAA satellites will be different from those recovered from a specific type of Soviet METEOR spacecraft, which in turn may differ from other experimental METEOR or COSMOS satel-

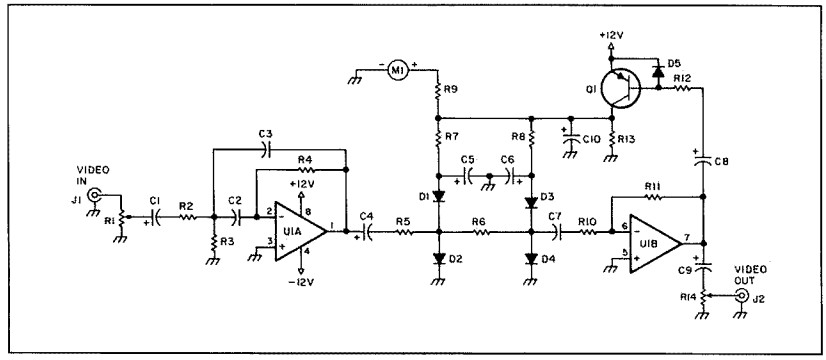


Fig. 2. Schematic of the satellite video pre-filter and agc unit. Parts values are provided in Table 1.

U1	MC1458 dual op amp
Q1	2N4403 (general-purpose PNP audio)
D1–D5	1N914 or other general-purpose diode

Resistors: Unless otherwise noted, all values are in Ohms; everything except the pots are 1/4-W, 5%, metal film or composition.

R1	10k PC pot (AGC THRESHOLD)
R2, R7, R8	10k
R3	2700
R4	20k
R5, R6	4700
R9, R13	47k
R10	1000
R11, R12	120k
R14	10k PC pot (GAIN)

Capacitors: Unless otherwise noted, all values are in uF: M = mylar (100 V), T = tantalum electrolytic (16 V min.), A = aluminum electrolytic (16 V), and D = disc ceramic (50 V).

C1, C4, C8, C9	1 T
C2, C3, C7	0.01 M
C5, C6	22 T (6 V)
C10	100 A
C11, C12	0.1 D
J1, J2	RCA phono jack
M1	50-microamp panel meter (agc), available from Radio Shack

Table 1. Video filter/agc parts.

Date	01 December 1986	
Spacecraft	NOAA-9	NOAA-10
Orbit Number	10137	1058
Eq. Crossing Time (UTC)	0045.87	0125.43
Longitude Asc. Node (Deg. W.)	148.55	88.87
Nodal Period (Min.)	102.0638	101.2979
Frequency (MHz)	137.62	137.50

These orbital parameters are projected two months in advance due to deadline considerations. Accumulated errors due to uncompensated orbital decay and other anomalies result in expectation of errors up to two minutes and possibly as many degrees in terms of the crossing data and possible small changes in the indicated period. Users requiring precision tracking data should rely on more current sources.

Table 2. TIROS/NOAA orbital predict data.

lites. WEFAX deviation levels can differ significantly, even from the same spacecraft, since the output signal on the WEFAX downlink simply mirrors the uplink signal, which is subject to both ground equipment and operator foibles.

Most of this unavoidable variation can be minimized in any display system by the addition of automatic gain control (agc) prior to video processing. Fig. 2 shows a simple front-end circuit to accomplish this with the added bonus of pre-filtering of the video signal.

U1A is one section of a dual op amp wired as an active audio bandpass filter. The circuit has unity gain, a center frequency of 2,400 Hz, and a bandwidth of approximately 1,600 Hz. Placing this filter at the input of the circuit module provides two functions. The first is the obvious one of minimizing the effect on the display of noise outside of the video passband.

The second function is to minimize the effect of noise on the agc section that follows. The output of U1A is routed through a two-stage diode attenuator consisting of four 1N914 diodes (almost any diodes will do as long as they are all the same type). The attenuation level in this network is directly proportional to the dc control voltage applied to the two 10k resistors, a subject I will return to momentarily. The output from the diode attenuator network is applied to the input of U1B, an op amp with a fixed voltage gain of about 120. The output of this amplifier drives a PNP transistor, which functions as the agc detector, producing a control voltage on the collector.

Relatively high drive from U1B will produce a higher control voltage on the collector than a low-drive condition will. This control voltage, when applied to the diode attenuator network through the two 10k resistors, effectively controls the attenuation level of the network that provides the drive to U1B.

Should the input peak signal level increase, the output from U1B will increase, causing an increase in the control voltage at the collector of Q1, and this will cause an increase in the attenuation of the diode array, reducing the output from U1B! Similarly, if the peak amplitude at the input decreases, the output from U1B will fall, reducing the agc control voltage, which in turn reduces the diode attenuation, causing the output of U1B to increase.

In effect, the peak output from U1B, which provides the drive for your display system, is in dynamic equilibrium, maintaining a very constant peak output level despite variations in peak input level. The input RC network to Q1 controls the attack time of the agc system (essentially fast), while the components in the collector of Q1 set the decay time constant (relatively slow). The values shown provide effective agc action without "pumping" in response to the video modulation waveform. M1 is a 50-microamp panel meter that monitors the agc control voltage and provides a visual indication that you are within the linear agc control range.

Construction

Construction of the pre-filter/agc module is quite straightforward and can be done using perfboard. Common sense dictates a reasonably compact layout, particularly around the diode network and the agc amp. I don't know what the "outer limits" are in this regard, but I have duplicated the circuit many times with no problems.

Only a few things are critical enough to triple-check! The first of these is the polarity of the agc diodes. The second concerns the basing of Q1. Note that this is a PNP device and the emitter *must* go to +12 V. Put it in backwards or use an NPN unit and you will have problems. The final point concerns the tantalum capacitor in the base lead to Q1. Note that drive is applied to the negative lead of the cap with the positive lead going to Q1. You must observe this orientation or the circuit will not work!

Setup

Preset R1 (AGC THRESHOLD) and R14 (GAIN) so that the center arm of both pots is at ground (minimum gain). Connect the output of the receiver to J1 and set the receiver to an unused channel so that the unit is driven by noise. When you apply power, the agc meter (M1) should bounce up to full scale and then slowly decline to zero. If the unit pegs at 50 microamps, turn off power and check the installation of C8, Q1, and D5.

Slowly advance R1 until the agc meter indicates a reading of 15. At this point, the GAIN control should be adjusted to the desired output level. An audio amplifier, connected at J2, should yield an undistorted version of the original signal. The best way to check this is with a modulated satellite signal. With a modulated signal at the input, the agc meter should read about 15—retrim R1 if this is not the case.

Use

In use, the module is simply placed between your video source (receiver, tape, etc.) and your normal display system. All of your sources should produce an agc meter reading of between 10 and 20, indicating the linear portion of the agc range. It is best to set the AGC THRESHOLD control as indicated and then adjust the gain of other sources so that they fall into the 10–20 range. Output gain can be set to any convenient value to drive your display. The most convenient level, assuming you have already optimized your display contrast, is a peak level that corresponds to what you used to get directly from the receiver. Not only will this module provide desirable filtering, it will also virtually eliminate knob twiddling when switching from one spacecraft or video source to another!

Subcarrier Frequency

I have previously noted that the video subcarrier frequency is at or close to 2,400 Hz. In the case of all

U.S. spacecraft, the frequency is precisely 2,400 Hz and the subcarrier signal can serve as a frequency reference for the display timebase. *Some* Soviet spacecraft have their subcarriers precisely locked, but most operational 120-line/minute METEOR spacecraft do not.

In general, it is probably not desirable to lock your display to the subcarrier as a frequency reference. The only advantage to this technique is that it makes possible the use of a monaural tape system for recording. On the minus side, the technique does not work with all Soviet spacecraft, it is subject to loss of frequency lock with signal fades, and, finally, it is not as versatile a timebase standard as we really want! If we go to an external timebase, we must use a stereo tape system for recording, but this is a small price to pay for the versatility we will get by going that route.

Earlier I made reference to the fact that the "normal" black level is about 4% of peak subcarrier amplitude. In some cases, ground equipment problems will result in a condition where WEFAX signals will go to 0% amplitude on black. This loss of subcarrier can disrupt the phase-lock time base, causing a progressive loss of image sync. A similar condition occurs during severe storm operations where the high-resolution VISSR signal is transmitted along with the WEFAX signal, causing repetitive dropouts that will cause a loss of subcarrier sync-lock. Thus, although the WEFAX S-band signal would appear ideal for a subcarrier-locked sync system, since fading does not occur, even this format has problems that limit the usefulness of locking to the subcarrier.



Photo A. An early winter storm in the process of burying the Great Lakes area. The image was obtained from an afternoon TIROS/NOAA pass in visible light.

Picture of the Month

This particular picture is quite seasonal in that it shows an early winter storm in the process of burying the Great Lakes area. The image was obtained from an afternoon TIROS/NOAA pass in visible light. The pass was automatically recorded using the "Zapper" omnidirectional antenna from the *WSH*. Lake Winnipeg shows through a bit of noise at the top, just left of center, while James Bay and a bit of Hudson Bay are visible just to the right of top center. All of these bodies of water, and most of Lake Superior, visible just above the center of the image, are ice-covered, but the lower Great Lakes, of which a bit of Lake Michigan and Lake Huron are visible, are still ice-free. Two fronts are stacked along the Appalachians in the lower right. Visible in the original, but probably missing in this reproduction, is a bit of the Mississippi River system slightly to the left of center along the bottom of the picture. The picture was printed on the direct-printing FAX recorder described in the *WSH*.

Note

References to the *WSH* refer to the Third Edition of the *Weather Satellite Handbook*, available from the author for $12.50 postpaid in the U.S. and Canada and $14 elsewhere.

Next Time

In my next column, I will look at the various sorts of timebases that are required for a satellite station.■

ATV

Number 13 on your Feedback card

Mike Stone WB@QCD
804 Jefferson Avenue
Lowden IA 52255

Direct reader response mail to my home address has been very good, indicating that there is a lot of new (and old) interest in the ATV modes. I will try to answer as much mail as possible. Always include an SASE with any correspondence. Most of your mail is asking: "Is there any UHF FSTV activity in my area?" and "What is the best equipment to build or buy?" and "How strong is color SSTV on the bands today?"

I have prepared a special informational packet of material that includes all 1986 USATVS State Section Manager listings and filed activity reports. This covers about 70–80% of the country and gives callsigns and names of ATV groups that will answer a lot of your questions and tell you who might be nearby to help you get started. To obtain this report packet, send me an SASE with an extra 22-cent stamp on it. Mark "USATVS 1986 Report Packet" clearly on the outside of the envelope.

Before I get technical in this month's column, I'd like to ask a simple favor of you all. Many of you old-timers on ATV (FSTV and SSTV) have been complaining about "lack of coverage" by some of the leading national amateur radio magazines. W2NSD/1 and KW1O have now given us this great opportunity via this column! A regular monthly column on this mode is a service to those who have not yet tried out the FUN of ham television. *We need to receive your responses!* Please take a few moments to fill out the Feedback response postcards in each issue. Let *73* know that you are indeed reading this column with great interest, and tell them what your favorite articles and columns are each month, so they will continue for a long time!

FSTV Possibilities

What types of TV pictures are transmitted by fast-scanners? Is the sending of commercial movies legal? Does sound accompany the picture as on commercial TV?

Perhaps the most common and enjoyable TV pictures sent on UHF ATV are from one-on-one QSOs in the shack. There is your ATV friend—across town, a few cities away, or maybe over a distance of several hundred miles out of state—sitting in front of the camera, looking right into your eyes, and "talking" with you! "Here's the latest circuit board I am building, John," says an ATVer as he does a zoomed close-up of the device. "Here come the XYL and the kids and they have taught Rover a new trick tonight to show you. Stand by!"

Many times, with the popularity of VCRs, home movies are sent. Other possibilities include vacations, Field Days or special events, lectures and talks, DX band-opening accomplishments, on-the-air tests, parades, air shows, and so on—the field is unlimited. No, commercial movies are illegal to send over ATV, so file that copy of "Star Wars" away for another galaxy.

Sound does indeed accompany the video picture, and there are a number of ways to send it. I will get into that in a future column.

The uses of ATV are many. Our ATV group has put a man in a hot-air balloon and sent him aloft for great ATV pictures, set up two separate FSTV-transmitting stations on the rooftops of college buildings to give go-cart race coverage of hidden (potential trouble)

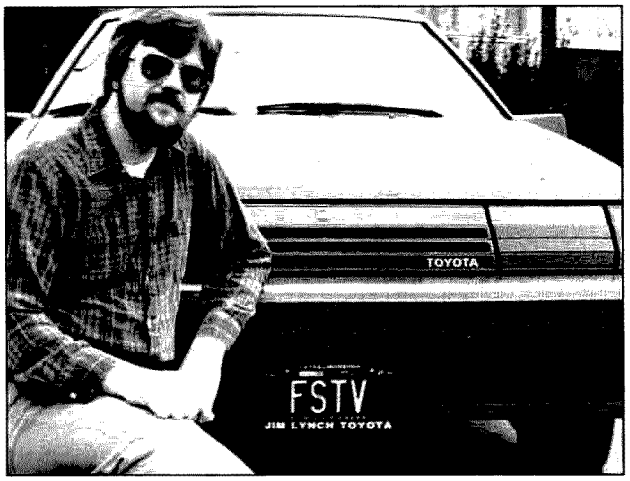


Photo A. Dave Williams WB0ZJP proudly proclaims his hobby on his new license plate.



Photo B. 325-mile ATV DX received by WB0ZJP in St. Louis, Missouri.

areas to officials, went on wintertime "hidden video transmitter" hunts with ATV-equipped mobiles, equipped an Air National Guard helicopter with color FSTV gear for some exciting aerial views of our area, and much more!

The Hillsboro, Illinois, ATV gang likes to shoot local parades and pipe the narrated coverage with "on-the-street reporters" into a large nursing home/hospital complex. Washington, D.C.'s Metrovision ATV group (and a number of others in the U.S.) tracked all the Space Shuttle flights, with 24-hour raw video displayed on each mission. Southern California ATVers cover yacht races, the famous Pasadena Rose Parade, and a number of other public events.

ATV repeaters can really get fancy with independent remote transmitter mode positions, which can include touchtone™ screen displays, such as color bars, live feeds, computerized graphics, security cameras, RTTY/packet/AMSAT window feeds, interactive game ports, SSTV feeds, Morse-code mode-testing displays, VCR replays, and so on. Once you become an "active member" of an ATV group, you'll find a whole new world out there full of experimentation, testing, building, education, friendship, and fun.

The Cheap Way to Do It

While I was writing this column in late September, my buddy Don KA0BVT in Moscow, Iowa (whom I got started on FSTV about seven years ago), was attempting a new experiment. I sent him my UHF TV video picture of the shack at about 100 Watts of power, while he tried to receive me direct with no interfaced downconverter on his new cable-ready VCR. The distance between us is about 25 miles over very hilly terrain.

His two 88-element and my four 48-element Jaybeams (along with power) normally will give a P4-to-P5-picture signal level. He saw a good picture of my signal just by tuning below channel 14 on his VCR UHF tuner with his ATV beams being connected to the UHF TV connector! The signal level was about P2 (locked and readable). Then he took his Advanced Receiver Research preamp and added it in-line. My signal was now a rock solid P4 with very little noise! *No downconverter*—just straight UHF tuner receive!

You can try the same thing on today's solid-state TV sets. Some will slide tune down below channel 14 (470 MHz) and catch 430 to 440 MHz. Few go much lower without modification. With the purchase or construction of a good high-gain UHF antenna (and maybe a preamp), this method, although not recommended as a permanent setup for viewing FSTV in your area, might just be a cheap way to try seeing ATV activity! Coordinate your viewing times with those who can transmit a picture to you. You need to know where the video troops are hanging out on 2-meter FM (this information is also included in the SASE package).

Antennas for UHF ATV

ATV manuals will talk about a number of UHF-style antennas that can be used for FSTV operations. Skeleton Slot and yagi antennas are popular, and K2RIW designs (cut for ATV) are beginning to take over third place—but the two multi-element beam arrays that stand out among all others are the 27-element KLM and the English-made Jaybeams.

It is clear that wide bandwidth is needed for the sending and receiving of ATV pictures. Both KLM- and Jaybeam-manufactured products handle this requirement quite well—much better, in fact, than standard, narrower bandwidth yagi designs. The KLM model uses a series of crossed interfaced driven elements to achieve good results, while the Jaybeam relies on the bend designed into the elements.

Both antennas are comparable in gain. ATVers do not always go just for the highest forward gain in an antenna as do 432 EME/SSBers, for example. Transmitting and receiving the 3.58-MHz colorburst and the 4.5-MHz audio subcarrier sound signals are a must! Both models will handle all the power you can legally throw at them. KLM 6-, 14-, and 27-element beams are available at most dealers or via P.C. Electronics. The more popular Jaybeams can be ordered through John Beanland G3BVU/W1 at Spectrum International, PO Box 1084, Concord, MA 01742.

My preference is with the Jaybeams. I run a stacked quad array of 48-element models using a phasing harness. I would run the 88s, but the winds here in the Midwest just won't allow it. With 100 Watts of power, hardline, a mast-mounted preamp, and these antennas, my best summertime FSTV UHF DX has been to WB8ELK in Findlay, Ohio—over 400 miles away! I see P1 to P2 pictures or hear the carriers (on FM/SSB) from Chicago about 150 miles away just about any time I want to. It's taken a lot of work to get that sensitive! Locally out to 50 miles, pictures are usually P3 to P5 in signal strength with the preamp on. As stated earlier, do it right and it will work for you!

Low-Loss Coax Is a Must on UHF

Up until the past couple of years, Belden 8214 and Saxon 8285 coaxial cable were the minimum accepted models in FSTV circles, less, of course, the preferred use of 50-Ohm hardline. Today, Belden 9913 and International/Columbia 1180C are accepted as the best of the flexible RG-8/U-type coaxial cable runs to use on UHF. Loss is rated at around 2.5 dB per 100 feet at 400 MHz. Anything less than these models and you will lose more than one-half your transmitted and received signals. I can't emphasize enough how vitally important this can be. Unfortunately, it is usually the most neglected feature of the station.

Get the best that you can afford to buy, of course. Higher priced, double-shield stuff is not always the lowest loss on UHF. It was made primarily to keep rf out, not in. Spend that extra few pennies per foot for the best.

SSTV—To Go Color or Not to Go Color?

Nearly every hamfest flea market will turn up a number of good buys on older SSTV gear. The Robot Research Model 400 is still

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NM12AL	N Conn., 1/2" Alum. (Male or Female)	22.00
NM12CC	N Conn., 1/2" Copper (Male or Female)	22.00
NM78CC	N Conn., 7/8" Copper (Male or Female)	54.00

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1102	RG8 95% Shielded Foam	30.00	.32
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1130	RG213/U Mil. Spec. 96% Shield	34.00	.36
1140	RG214/U Mil. Spec. - Dbl. Silver	155.00	1.65
1180	Belden 9913 Low Loss	46.00	.50
1705	RG142B/U Teflon/Silver	140.00	1.50
1310	RG217/U 5/8" 50 ohm Dbl. Shield	80.00	.85
1470	RG223/U Mil. Spec. Dbl. Silver	80.00	.85
1450	RG174 95% Shielded Mil. Spec.	12.00	.14

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8C1822	2-18 Ga., 6-22 Ga.	19.00	.21
8C1620	2-16 Ga., 6-20 Ga. Heavy Duty	34.00	.36

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NE720	Type N for Belden 9913		4.25
NE723	N Female Belden 9913		4.75
PL258AM	Amphenol Barrel		1.45
PL259	Standard Plug for RG8, 213	10/5.90 or	.65
PL259AM	Amphenol PL259	10/7.90 or	.89
PL259TS	PL259 Teflon/Silver		1.59
UG21D	Type N for RG8, 213, 214		3.00
UG83B	N Female to PL259		6.50
UG88C	BNC RG58		1.25
UG146	SO239 to Male N		6.50
UG175/6	Adapter for RG58/59 (specify)	10/2.00 or	.22
UG255	SO239 to BNC Amphenol		3.75
KA51-18	TNC RG58		4.35
AM9501-1	SMA RG142B		8.95
SO239AM	Amphenol SO239		.89

GROUND STRAP — BRAID

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GS38	3/8" Tinned Copper	.30
GS12	1/2" Tinned Copper	.40
GS316	3/16" Tinned Copper	.15
GS316S	3/16" Silver Plated	.35

GROUND WIRE — STRANDED

Nemal No.	Description	Per Ft.
HW06	6 Ga. insulated stranded	.35

Call or write for complete price list. Nemal's 32-page Cable & Connector Selection Guide is available at no charge with orders of $50.00 or more, or at a cost of $4.00 individually.

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a very sought after piece of gear. A few years ago, it sold for $795 and you were lucky to get one. Today, the black-and-white units can be found new for $300 or used for between $150 and $250. If you are interested in getting into SSTV but do not want to spend a large amount of money just yet, buy one. Many hams have converted them to color later on.

The units display a very clear picture of 128 pixels across (the little dots on the TV screen) by 128 lines down. Sixteen shades of gray are represented, although you usually can count only seven or eight. This piece of gear is a far cry from the days of P7 image display tubes when W2NSD saw his first boring SSTV pictures.

Bob Walker WB0VVY of Atkins, Iowa, made the conversion to color on his Robot 400 in a few nights with an upgrade kit supplied by Robot Research of San Diego, California. He now enjoys both black-and-white and full color (4,096 colors) SSTV pictures at 8-, 12-, 24-, 36-, and 72-second picture transmission and reception rates. True, the color is not quite as good and detailed as the more expensive top-of-the-line Robot 1200C converters, but then Bob doesn't have $1,300 wrapped up in it either.

If money is no object, then the 1200C converter right now is the way to go on SSTV. Robot Research has a neat four-page informative color brochure on these units. Write to them for details. I would say that about 70% of the SSTV transmissions today are being done in color. But seeing these pictures in black and white is still great viewing.

The pioneering efforts of G3NOX, VE3EGO, K6AEP, W9NTP, WB5MRG, DL2RZ, and others, and most notably those of KD6HF and WA7WOD, have brought color SSTV to what it is today. Some of the best ATV "experimentation" is taking place in the slow-scan ranks. Syd Horne VE3EGO's work in interfacing SSTV with packet radio for error-free pictures is going to be the next big step in SSTV. Tom Hibben KB9MC and Don Miller W9NTP are working together on putting out a "new" SSTV manual. It will be published by the League some time in 1987. There hasn't been a good handbook on SSTV for a number of years, and so much has happened since Don Miller, Ralph Taggart, and Dave Ingram K4TWJ wrote the last ones.

14.230 MHz is still the hot spot to tune in SSTV operations, but some DX is being heard again on 28.680 MHz. When 10 comes back in, be on the lookout for good low-power SSTV pictures once again.

W0ORE's SSTV pictures from the *Challenger* were very exciting for those who were equipped for watching, but wait until the manned space station project gets into orbit and nearly "live" SSTV pictures and perhaps "live" FSTV pictures are transmitted from above the earth. We are working with W5RRR at the Johnson Spacecraft Center ARC for this to become a reality. You will want to be part of it.

Cheap SSTV via the micro is possible at greatly reduced resolution. Dick Kinney of Kinney Software in Hamilton, Ohio, has a couple of versions of programs and interfaces for the CoCo and C-64 computers. I'd personally like to see IBM PC enthusiast Clay Abrams K6AEP take a relook at the new, higher resolution CoCo 3 computer with some of his former SSTV programs. Howard Nurse W6LLO of Commsoft has some very serious SSTV applications for Apple computers interfaced to CCTV cameras.

Whatever route takes you into slow-scan, the important thing is to get on and get your feet wet. If nothing else, tune into 14.230 early Saturday afternoon at 1800 UTC to the W1JKF/W9NTP SSTV net. Jump in, give your callsign, and tell Brooks or Don that you're interested in getting started on SSTV. They'll take it from there.

A Final Note

These first three columns have pretty much been basic material to get YOU, the newcomer, better acquainted with how fast-scan and slow-scan TV signals originate and are received, along with the types of programming sent over the air. Starting with my next column, I'll concentrate more on specific pieces of equipment, standards, and good operating techniques. More specifically, I'll talk about the camera, building FSTV repeaters, whether to use AM or FM, and a history lesson on SSTV development in the U.S. See you on the tube.■

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"What's in it for me?" comes the cry from our faithful readers. Besides the knowledge that you're helping us find out what you like (and don't like), we'll draw one Feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save some money on stamps, why not fill out the Reader Service card, the Product Report card, and the Feedback card and put them in an envelope. Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 22 cents!

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Congratulations to Richard Oden of Pass Christian, Mississippi, this month's winner of a one-year subscription.

NK6K > PACKET

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PACKET POLL

Welcome to the first large-scale packet radio survey. Even the most incorrigible Luddites now agree that packet has made a significant impact on amateur radio in the 80s. We would be remiss in our duties to future historians if we did not try to record some of the demographics of the early days. Our future selves will no doubt look back at 1986 and laugh that we were still running at 1200 baud and were still shoving audio into the mike jack of our radios.

Please respond to this poll if you are on packet now or if you have been on at any time in the past and (gasp) dropped it. Feel free to not respond to specific questions.

I'd like to get most of the responses via packet (NK6K @ NK6K) or via CompuServe (71635,1174). You may also use paper; just cut out and mail the response form given below to the address given at the top of this column. I've asked that this column be printed with one of the W2NSD editorial pages on the back so you won't miss anything important when you cut out the response form, but in case that doesn't work out, feel free to send in a copy or scrawl your responses on a piece of paper of your own choosing.

If you reply via packet, put several number/letter pair responses on a single line to speed up the transmission from BBSs that send one line per packet, and separate the responses by commas: e.g., 1b,2c,3a, etc.

If, on the off chance that you've read this far and aren't on packet, and you think that packet is ruining amateur radio, by all means mail in a piece of paper with "No on Packet" written on it.

Definitions

For the purpose of this survey, "packet" is used as a shorthand word for any high-speed digital communications over amateur radio. This is just as wrong as saying "2400 bps" is the same as "2400 baud," but you know what I mean. So, in this survey, high-speed digital is defined as 300 baud and up, without using the Baudot or AMTOR techniques. Thus, the 9600-baud polling system used in eastern Canada in the early 80s counts as "packet." VHF is shorthand for "not HF" and includes 2 meters and above. BBS is short for any system where a computer is the primary "operator"—bulletin boards, mailboxes, file servers, hosts, private message systems, etc. TNC is short for whatever device it is that you use to do your high-speed digital communicating with.

Finally, thanks to WB6YMH and KA9Q for reviewing and suggesting some questions, and an acknowledgment to the annual KI2U Funl poll, where I lifted some of the demographics questions.

1) Sex:
A) Male
B) Female

2) Age:
A) 15 or below
B) 16–21
C) 22–39
D) 40–59
E) 60 and up

3) License class:
A) Novice
B) Technician
C) General
D) Advanced
E) Extra

4) Number of years licensed:
A) 1 or less
B) 1–5
C) 6–10
D) 11–20
E) 21 or more

5) Year you first used "packet":
A) Before 1980
B) 1980–1983
C) 1984
D) 1985
E) 1986

6) I first heard about packet from:
A) Friends/on the local repeater
B) Demo at a club meeting
C) Demo at a convention
D) Demo at Field Day
E) Magazine articles

7) My job is (or used to be):
A) Computer related
B) Rf related
C) Other

8) Aside from jawing on the local repeater, has the majority of your amateur radio activity lately been packet related?
A) Yes
B) No

9) Number of TNCs owned:
A) 1
B) 2
C) 3
D) Many

10) Do you use the AX.25 protocol?
A) Yes
B) No

11) Are you running (or do you also run) a protocol other than AX.25? (Also answer yes if you are pushing IP or other protocols through AX.25 UI frames.)
A) Yes
B) No

12) Do you have a radio devoted exclusively to packet?
A) Yes
B) No

13) Do you run a digipeater or other digital repeater where that station is up 24 hours a day and its primary purpose is to relay data for others? (Don't answer yes if you simply have DIGI ON set in your TNC.)
A) Yes
B) No

14) If you run a HOST/BBS systems, do you:
A) Run an WØRLI or RLI-clone BBS
B) Run a BBS that can forward to/from RLI systems
C) Run a different type of BBS
D) Do not run a BBS

15) Where do you use packet?
A) Mostly on VHF
B) Mostly HF
C) HF and VHF

16) Your packet operation is:
A) Mostly real-time person-to-person chats
B) Mostly BBS messaging/file transfer
C) Both

17) Do you have a forwarding BBS (RLI-style) in reasonable range of your station (one or two hops)?
A) Yes
B) No

18) Do you make frequent use of the forwarding feature of your local BBS?
A) Yes
B) No

19) Have you built or designed anything for packet, for your own use or others? This includes hardware (TNCs, modems, connect alarms, tuning indicators, etc.) and software (terminal drivers, BBS systems, etc.). Kits don't count.
A) Yes
B) No

20) Did you put your TNC together from a kit?
A) Yes
B) No

21) Would you be in favor of some type of "digital license," one that gave primarily digital privileges on non-HF frequencies, required a technical test with digital-specific questions, and did not require a Morse-code test?
A) Yes
B) No

22) Would you be in favor of something more than the question above, a "no-code" license that gave wider ranging privileges on non-HF frequencies?
A) Yes
B) No

23) Are you against ALL types of codeless license?
A) Yes
B) No

24) Did you get your ham license as a result of hearing about packet radio?
A) Yes
B) No

25) Do you know of anyone who got his license as a result of interest in packet radio?
A) Yes
B) No

26) The computer you currently use for packet is:
A) Commodore 64
B) Apple II
C) Z-80/8080-based system (Xerox 820, etc.)
D) IBM PC/XT/AT and clones
E) Macintosh
F) Dumb terminal
G) Other

27) On the computer you use for packet, do you have:
A) Floppy disk drive
B) Small hard disk (10 meg or less)
C) Large hard disk (greater than 10 meg)
D) No disk storage

28) What do you think about hams who send "digipeater on" beacons?
A) Tar and feather 'em
B) Put 6" steel spikes in their eyes
C) Put bamboo shoots under their finger nails
D) Beacons don't bother you

29) The "packet network" available in 1986 is:
A) More than you thought it would be when you first got on packet
B) Less than you thought
C) Pretty much what you'd expected

30) Is HF your only link to other packet users?
A) Yes
B) No

31) Is HF your only link to a BBS system?
A) Yes
B) No

32) Most of the data sent on packet today is message text or programs. There are also several oth-

RESPONSE FORM

1)	A	B				13)	A	B				25)	A	B						36)	A	B	C	D
2)	A	B	C	D	E	14)	A	B	C	D		26)	A	B	C	D	E	F	G	37)	A	B		
3)	A	B	C	D	E	15)	A	B	C			27)	A	B	C	D				38)	A	B	C	
4)	A	B	C	D	E	16)	A	B	C			28)	A	B	C	D				39)	A	B	C	
5)	A	B	C	D	E	17)	A	B				29)	A	B	C					40)	A	B	C	
6)	A	B	C	D	E	18)	A	B				30)	A	B						41)	A	B	C	D
7)	A	B	C			19)	A	B				31)	A	B						42)	A	B		
8)	A	B				20)	A	B				32)	A	B	C					43)	A	B	C	D
9)	A	B	C	D		21)	A	B				33)	A	B						44)	A	B		
10)	A	B				22)	A	B				34)	A	B	C	D				45)	___			
11)	A	B				23)	A	B				35)	A	B	C	D				46)	A			
12)	A	B				24)	A	B																

er types of data, such as digital audio, digital video, graphics, telemetry, etc. Regarding non-text data:

A) You have used non-text digital communications
B) You would use it if equipment was readily available
C) You have little interest in non-text digital communications

33) Do most of your packets go through a digipeater?

A) Yes
B) No

34) How many digipeaters can you hit directly? (By digipeater, I mean a device or TNC on the air 24 hours a day with the primary purpose of being a digipeater. Remember to include all the frequencies in use in your area.)

A) 0–2
B) 3–6
C) 7–12
D) 13 or more

35) How many BBS systems can you hit directly?

A) 0
B) 1–2
C) 3–6
D) 7 or more

36) How many BBS systems can you hit using no more than one digipeater?

A) 0
B) 1–2
C) 3–6
D) 7 or more

37) Have you used packet in a public-service activity?

A) Yes
B) No

38) Do you think the current Part 97 regs on digital communications are:

A) Too restrictive
B) About right
C) Not restrictive enough

39) Is packet a part of your local emergency communications plan?

A) Yes
B) No
C) Don't know

40) In your area, are the packet frequencies:

A) Too crowded
B) Sparsely populated
C) Just fine

41) In your area, how many VHF frequencies are in active use for packet:

A) 1
B) 2
C) 3–6
D) More than 6

42) In your area, forwarding BBS systems are:

A) Using too much channel time
B) Not a problem

43) Regarding your packet use, do you:

A) Use it less than you once did
B) Use it more now than before
C) Stayed the same
D) Dropped it all together

44) Were you a Baudot (RTTY) or AMTOR user before you started on packet?

A) Yes
B) No

45) Enter the two character post office abbreviation for your province or state (in North America) or your callsign prefix (including number) if you are DX.

46) Enter A if you saw this poll in *73* Magazine.

A)

QRP

Number 22 on your Feedback card

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Last month we talked about mail-order parts suppliers. Let's look into some of the smaller suppliers. In particular, the suppliers that handle the makings of QRP radios. After that, we'll look at some of the more common parts that should be in everyone's junk box.

If you're looking for a one-of-a-kind part for your latest project, send an SASE to KA1BUQ at PO Box 249, Luther MI 49656. Here you'll find Doug DeMaw and son. While not sending out a catalog proper, their flyer always has the latest in QRP rf devices and other goodies.

Toroidal Cores

I seem to hear it all the time. Why do they use those rotten toroids in almost every QRP project? Well, I don't have the space to answer that one for now, but maybe later. I do know you should send for the latest information about toroidal cores to Amidon Associates, 12033 Otsego Street, North Hollywood CA 91607. Amidon sends out a slick "tech-data" flyer that I use all the time. It's worth having by itself. Amidon will sell in single lots and has very quick service. I'm sure you'll find them a welcome supplier.

Coils

I can solder up a storm all night long. Burn the midnight oil working the bugs out of a transmitter. But I just can't stand to wind those coils. Well, help is nearby. Caddell Coil Corp. just loves to wind coils. Many of the coils used by the most popular projects found in the ham magazines can be purchased from Caddell. Write to them for their latest catalog at 35 Main Street, Poultney VT 05764.

PC Boards

While winding coils is surely not for me, I really don't mind making the printed circuit boards. But there sure are a lot of people who hate that as much as I hate coil winding. For those of you who would rather shell out the bucks, drop a letter off to Circuit Board Specialists, PO Box 969, Pueblo CO 81002. While they don't print an expensive catalog, they will send you a flyer listing their newest boards. As their stock changes all the time, you'll keep your catalog file updated with CBS's latest flyer.

With more and more QRP projects requiring circuit boards, several other board manufacturers have appeared. Among the best of the lot is A & A Engineering, 7970 Orchid Drive, Buena Vista CA 90620. Send for their latest catalog. It also is updated as new projects come on line.

In the past two months I have mentioned a lot of parts suppliers. All of these I have done business with and have had very good results. As consumers, we should always keep one eye out for trouble. If you have done business with a supplier and had good results, drop me a line. We'll tell the world of their good business practices. Likewise, if you've had trouble with a supplier, let's get the word out.

Catalogs

I have been building QRP projects for quite some time now and have never run across a part that I could not find. Oh, yes, I had to do some letter writing to find just what I needed and perhaps paid more than I wanted to, but I always got the project done. If you don't have time to write for catalogs, how do you get a supply? That's really quite simple and very easy. In the back of this magazine you'll find the Reader Service card. Mark the advertisers' numbers, drop it in the mail, and then sit back and wait. In a short time

you'll be up to your nose in catalogs. Suppliers that choose not to use Reader Service numbers should be contacted directly. When you place an order with a supplier, mention that you saw the ad in *73*. That way the supplier has a way of tracking his advertisements.

Selecting a Supplier

Now that we've armed ourselves, let's determine which supplier to send our order to. I use several benchmarks in my purchasing. For an example, let us say that we need some IC chips for a CMOS keyer. I would first gather up all the catalogs from the suppliers that sell chips. Next, I would look up the price of 555 timer, 2N2222, 7400 TTL, 4001, and 4011 CMOS chips. Next, I would look up the prices of the chips that I need for the keyer. Compare the prices.

Stop now for a second. I may see that one supplier has a lower price than all the rest, but they have a $20 minimum order. They don't really specialize in IC chips, but rather in rf parts. That should make you think. Do they get their IC chips via a broom on the afternoon shift? Does their selection contain only a few of the very common types? Makes you wonder. If you're buying ICs, then stay with a supplier that makes a living selling them. There are, of course, several suppliers that sell a very large selection of both chips and rf components and do a very good job at both.

Now that I have picked the supplier for the parts, I look over the junk box. Since almost all mail-order firms have a minimum order and the total price of all my keyer parts comes to a little over eight bucks, I have to come up with the minimum order. The following is one part of Mike's Rule of Ten: I need only two 4011 chips for my project. They sell for 25c in single lots. That's a very popular chip. I use them all the time. The junk box has only one left in the drawer. In lots of ten, the price falls to 20c each. If I have the extra money, I'll order in units of ten, stock up the junk box, and have what I need for the keyer.

By keeping a close eye on the junk box, you can order what you need and save some money. I just hate to shell out two bucks for a 555 timer at Radio Shack (even if it is seven at night) to finish up a project. If I keep a good stock on hand and order in lots of ten, I don't have to. You never have enough 555 timers or 2N2222 transistors. (I really think that somewhere, someone will come out with a circuit for a color television using nothing but 555 timers and 2N2222 transistors. I plan to have enough of them in stock so I can start construction.)

The order is written out. Postage and handling charges are figured in. How you pay for the order, however, will help determine how long it takes for your order to get to you. Depending on the firm, personal checks take up to two weeks to clear the banking system. CODs cost extra and some firms will not ship COD. The best way to pay is with plastic money. Visa and Mastercard are honored by most mail-order firms (but be on the lookout for a service charge on credit card orders).

Many mail-order firms have toll-free phone numbers. Placing your order this way and using your credit card speed things up. Some companies have a higher minimum for phone orders.

In about a week the order arrives. Heat up the soldering iron and start to enjoy ham radio's best. There is nothing like the excitement of using gear that you put together yourself.

Junk Box

The best part of home-building your equipment is having the parts on hand. The QRP workshop should have resistors on hand from 100 Ohms through 2.2 megs. Transistors should include the 2N2222, 2N2906, MPF102, 40673, 2N3553, and 2N4416. The popular 1N914 diode should also be stocked.

Toroids should include FT-37-43, T36-6, T68-6, T50-2, T50-6, FT37-61, FT37-63, FT50-43, FT-37-2, T68-2, and T37-4. Add some ferrite beads to the pile also.

The following rf chokes will fit 90% of your needs: 1 mH, 10 uH, 200 uH, and 10 mH.

Capacitors, both electrolytic and ceramic, should include .1 uF, .01 uF, .001 uF, .2 uF, .005 uF, 100 pF, 560 pF, 470 pF, 330 pF, 47 pF, 56 pF, 750 pF, and 820 pF. Of course, the smaller values are either silver micas or polystyrenes.

This is just a small list, but expanding your junk box will allow for more flexibility with your next QRP project. ■

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FLEAING WITH MY LIFE

With summer just a faded memory, it's time to reflect on the concluded ham flea market season. Ham flea markets are good old-fashioned All-American fun. Heck, Field Day and flea markets are the only times many hams get out into the clean, healthy sunshine. Heroin addicts and prisoners have healthier complexions than most hams.

Going to a flea market is an exercise in escapism. You meet celebrities (I spotted famed subway gunman Bernie Goetz at a Long Island flea market this year), you eat hot dogs, fondle microphones, and ogle amplifiers. FUN, indeed. But there's a flip side to the coin as well—selling merchandise at a flea market.

If you've never sold stuff at a flea market, you should give it a try, since it's an experience no ham should miss. I'd rank it up there with going on a DXpedition to a tropical island, visiting ARRL headquarters, or eating the food at a ham banquet. All of these experiences hold their transitory displeasures, but you're not a *real ham* unless you endure them.

I got my taste of selling ham junk at a LIMARC ham fair a few years back. Ham junk, incidentally, is an interesting phenomenon, endlessly recyclable and apparently immortal. Have you ever seen a boat-anchor Hammarlund at Dayton that you swear you saw two years earlier at a flea market in Arizona? Radio amateur deja vu. That Hammarlund has probably been on the flea market circuit since 1957, passing from owner to owner at a rate of two or three hams per year.

My inspiration to sell ham junk came when I opened my garage door and saw a Hallicrafters SX-111 bounce off the roof of my '72 Corvette. Oops! Well, roof panels can be replaced fairly easily, if not inexpensively. (I got the new ones at a car-collector flea market, but that's another story.) So, fearing more potential body damage, I loaded my excess effluvia into my Ford and pointed it toward the Islip Speedway, the home of the LIMARC flea market in those days.

Pulling into the Speedway's parking lot, I paid my seller's admission fee and found a nice parking spot/sales location near the portable toilets, a locale guaranteed to attract a crowd. The fragrance, if you can stand it, also keeps browsers from cluttering up the area around your table. Since my job requires me to deal with PR flack on a regular basis, I have no trouble with odor.

There is an art to setting up a flea market sales table. I used a couple of folding picnic tables, which work nicely as long as you don't put too much weight on them (they bend). The idea is to place the cheap small stuff up front and the expensive big stuff in back. Few people make an impulse purchase of a $700 computer, but many are likely to impulsively pick up a 50-cent book (Barry Goldwater's autobiography was a big seller for me).

Price tags are also a must. Hams, as we know, tend to be wimps. Many are too bashful to ask for a price, or figure that their job as a driver for the Gotham Bus Company won't qualify them to purchase your high-quality merchandise. Anyway, if you happen to find a ham who is outgoing, the price tag will work as a good bargaining point.

Hams negotiate funny. Some are very picky over what are really quite mundane articles. For instance, I remember one fellow who made a big deal out of a BNC connector.

"This a BNC connector?"

"Yep."

"How much?"

"Fifty cents."

"What's it made out of?"

"I dunno. Metal, I guess." I'm getting bugged.

"It looks dirty."

"Wash it."

"I'll give ya thirty cents."

"No way," I say.

"Forty cents."

At that point, I picked up the connector and threw it at the guy's head. It missed.

He said, "No deal, I guess."

I said, "You're right, I guess."

The BNC broke the windshield on a nearby sedan.

Then you have the hams who will buy anything. For instance, there was one guy who bought a $220 Heathkit oscilloscope from me. It was only about a year old, and I was selling it for pretty close to list price. He didn't negotiate at all. "Like the scope, hate building," he said.

The strange part was that the OM didn't plug it in, didn't check my construction—nothing. Now, I'm a pretty good craftsman. I keep my leads short, tighten my screws, and apply white hot solder. But he didn't know that. He *trusted* me. I don't even trust myself. He paid me cash. He didn't know who I was. If it had been a bum scope, he would have been out of luck. Weird.

But the best part of selling at a flea market is meeting all of your friends.

"Hey! It's KI2U! Mr. Fun!" Oh, God, no. It was Jack, a flake who habituated a local repeater. Some dogs have fleas; this repeater had Jack.

"Lookee here! A box of floppy disks! They make great Frisbees!" A shrill laugh filled the air. Several nearby hams ducked for cover, thinking an ambulance was plowing through the crowd.

I grabbed the disks out of Jack's hands.

"Why don't you visit the ARRL booth?" I suggested.

"They chased me away three times," said Jack. "I decided to give equal time to Wayne's exhibit. Hey, is this cheap folding table the best Wayne could afford?"

"This isn't Wayne's table," I replied. "It's mine."

"Hard up for cash?" he said.

Before I could answer, a butterfly skittered by and Jack ran after it. He never came back.

A small miracle. But I wasn't out of the woods yet. Joe the DXer was headed my way.

"Fresh out of countries, Joe?" I said with a smile.

"Hmmmm," grumbled Joe. Like most honor roll DXers, Joe took ham radio seriously. It wasn't a hobby to him. It wasn't even a business. It was a sort of hair shirt.

"Got a 6146B?"

"Yes I do, Joe. It's right here. Let me see . . ." As I was reaching toward my tube box, a crackle shot through the air and a panicked, garbled voice screamed out of Joe's HT.

The blood drained from Joe's face.

"What is it, Joe? An emergency?"

"You bet," he said. "Flackaran's on 20."

Like Jack, Joe never came back either. In fact, I never heard from Joe again. I suspect he moved a bit closer to Flackaran.

On the whole, the day turned out to be profitable. I made $325, got a nice suntan, and learned something about my fellow hams. Would I do it again? Not on your life.■

ELEMENT 1 TRUE-FALSE

	True	False
1) After writing Fun! for more than five years, KI2U has finally exhausted his supply of ham trivia.	____	____

THE ANSWER

Element 1:

1—True You bet.

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Marc I. Leavey, M.D. WA3AJR
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Sometimes I wonder just how many of you pay attention to the little "tease" I try to leave at the end of each month's column. To save you the trouble of looking back, I alluded to the perennial contest I face answering all of your mail. Well, here I go.

Ed Kotz NG0R of Roggen, Colorado, writes with some modifications to the HAL ST-5A demodulator for computerized interfacing. You all may recall that back in July I recounted Ed's tale of woe in trying to make his secondhand ST-5 operational. He related that my "seed" in saying that the FSK output used ±15 V dc got him going. He devised the modifications shown in Fig. 1, which have his demodulator copying S1 signals, and even some buried in the noise, with good results. I thank Ed for his contribution, and I am sure that you all do, too.

Another letter this month comes from Gregory McIntire, who introduces himself as an SWL from Belle Fourche, South Dakota, and who has been enjoying copying RTTY on his Commodore 64 computer. Why not try to get a license, Greg? Transmitting is more than half the fun! Anyway, Greg has been looking at one of the more common RTTY exchanges, that of sending various forms of artwork by sending strings of MMMXXX III:::.:IIXXMM or such to create a likeness of anything from a girl to the man in the moon.

As Greg says, "I decided that this mode (RTTY) and its capabilities could be utilized for something more constructive. Why not use RTTY to send high-resolution pictures? How about hi-res schematic diagrams for the many electronics enthusiasts of the amateur community? Since I had never seen any software for the purpose of doing this, I decided that I must write the software myself. I did, and this is how it works with RTTY. First you 'draw' a schematic diagram on the C-64 monitor screen using the keyboard. Next you SAVE the drawing as a disk file. (You may also print the drawing on paper.) Now you can change the saved disk file to a list of numbers. This is saved as yet another disk file, either a sequential (SEQ) or program (PRG) file type, depending on which type your RTTY software requires. You may now 'fire up' your rig and transmit the list of numbers via Baudot, ASCII, or AMTOR. [I assume you could even send them via Morse.—mil] The person on the receiving end will also need a C-64 or C-128 and a copy of my software to reproduce the hi-res drawing."

I have printed Greg's icon menu and diagram in Fig. 2 and the list of numbers generated to reproduce the diagram in Fig. 3.

The concept is a good one, Greg, although not totally unique. The TRS-80 Color Computer crowd has a program called PIX-CMP, which does essentially the same thing with high-resolution CoCo pictures. In fact, the CoCo Program Listing included here will reconstruct the diagram shown in Fig. 1.

Now, here comes the hook. Why not work up a system that is computer independent? If you could come up with a scheme to generate a number list that could reproduce a similar picture on Commodores, CoCos, PCs, and even Ataris, *then* you would have something. I might even hazard a guess that *73* might be interested in printing the programming. Of course, if they won't, I will. Let me hear from you with your developments.

Staying with the Commodore fleet (sorry), here's a letter from Bob May, II K4SE of Jonesboro, Tennessee. Bob writes that for the past three or so years he has been using a VIC-20, Kantronics' Hamsoft program, and the MFJ-1224 interface for RTTY. He has been quite satisfied with the results. Recently, he bought a Comrex CR-220 printer, which works well on his Commodore software, particularly the word processor. However, when he pushes the control-P, while "P" appears on the screen, he gets nothing on the printer in either transmit or receive. He has tried another VIC-20 with similar results and wonders if I have any idea of what's happening.

Well, Bob, while no one I asked was familiar with the exact combination, a common problem did suggest itself. The programming for special keyed functions is of-

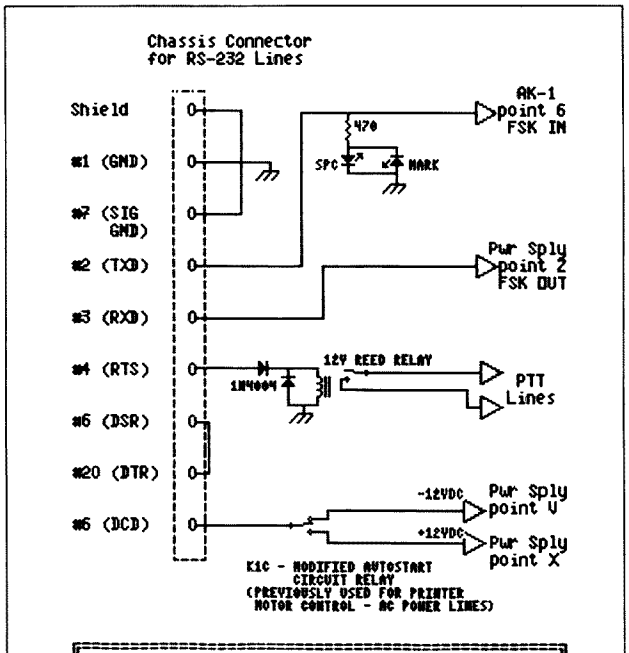


Fig. 1. Modifications to the HAL ST-5A RTTY demodulator for computer interfacing.

```
1 PCLEAR4:CLEAR200,&H5DFF:FOR X=&H7E00 TO &H7E95
2 READ H$:POKE X,VAL("&H"+H$):NEXT
3 DATA 9E,33,30,6,10,BE,5E,0,86,8,A7,8C,3A,86,6,A7,8C,34
4 DATA A6,80,80,30,48,48,48,59,6A,8C,29,27,E,6A,8C,25,26
5 DATA F4,E7,A0,C6,8,E7,8C,1C,20,EB,86,6,A7,8C,14,A6,80,26,A
6 DATA A6,4,81,22,26,C,30,5,A6,80,80,30,48,48,20,D9,0,0
7 DATA BE,5E,0,10,BE,E,0,A6,80,A7,8C,42,6F,8C,40,A6,80,A1,8C,3A
8 DATA 26,F,E6,80,A6,80,A7,A4,8D,10,8D,1D,5A,26,F7,20,4,A7,A4
9 DATA 8D,5,8D,12,27,E2,39,10,8C,25,E0,24,4,31,A8,20,39,31,A9
10 DATA E8,21,39,6D,8C,F,26,8,10,8C,25,FF,26,3,6C,8C,4,1A,4,39
11 IFPEEK(&HC000)=68THEN DK=1:GOTO 13
12 POKE&H7E40,6:POKE&H7E78,&H1D:POKE&H7E8C,&H1D
13 PMODE4,1:PCLS1:SCREEN1,1:READ I:EXEC&H7E00:FORI=1TO5000:NEXT
14 CLS0:LINEINPUT"FILENAME FOR PICTURE: ";F$:IFF$=""THEN 14
15 IFDK THEN SAVEM F$,&HE00,&H25FF,&HA027:END
16 CSAVEM F$,&H600,&H1DFF,&HA027:END
17 DATA1
100 "I_BPoiJX^mJIVo8Booj\IZh6[?8BooR_IZP5[088oob[Ij'3Z?8BooR_I:I
101 "3[?8Booj\OZP6[_88oobIO:\3[?8ZocOoIWIfHo88ogob4_moOomoI88oOg
102 "oogob4_moOomoO68FogobS?ooomoO68IooTagCgm>?88omVfHgAf^=ob4
103 "OoIJWJwMIW0omMfmoCfn?8:om2m08mm_Mob4OoAJMIwMKKOIG7odKIfLGFf
104 "go8Aom6jNMYjMob:OogakNgJlOb4_ndUXJVJICb4_o6IPCJm_oo19J6YfJ
105 "dIPIo^=K^kJIJhIQjO^=K^kJhIGjoO^g^kng^IGjoc;8MkjG=ITjoMk=m_K
106 "akmoBAognoocno?oooMk^m_KakmoB9ogMk_KfmmOb4Dag^kfm_G_gI07oM
107 "k_mOKekmoBAogNk_Gem^oB20mKJ7IkJi_comn\^m^k_?:conMkMeI5oooo
108 "edJ08mob3?oeoooblI?OoIPCgooB4moob1I?OoIPCgooB4moob1I?OoIPCgooB
109 "4moob1?OoIPCgooB4moob1?OoIPCgooB4moob1?OoIPCgooB4moob1?OoIP
110 "Cgoo84moob1?OoIPCgooB4moob1?OoIPCgooB4moob1?OoIPCgooB4moob1
111 "?OoIPCgooDgmonLNkgN>OoolDKfIOBfIPcoOOB5omb1?KiIQjonQB4m_Mb
112 "4_oiIPCfnOBBomb1?KiIQjonQB4m_Mb4_oiIPCfnOBBomb1?KiIPIokoo
113 ">jkno6ooo?Jao\JIob3?n7ooob1?Oom'3gmoob1?OoIPCgooB4moob1?OoO?
114 "OgmoobI?OoIPCgooB4moob1?LOIPCgooB4moob1?OoIPCgooDgm'3oIPCgo
115 "oB4moob1?OoIPCgooDgO?OoIPCgooB4moob1?OoIPCgo'3gmoOoIPCgooB4
116 "moob1?OoIPCgo'7mOOmIPCeoOOmmIOoognoOoooIngm<noOIOGo07B8o'3
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118 "3b5oIOIOOo07OFo'3bIOoJc>c\mOBLoIIJfUfJOoonOMknoMkbjOIOIPOoo
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137 "(if^JKO8boo?Jao_JIooOn=JKFdJoonoOcmo_kob9oo2MgOgmoOoooo7fJ
138 "IJFo8JookIoPkno?oo_mo_joOooIIPCno?8boo'NKVi^77mo_mo_joOo
139 "oI;IPAI3?8MomobIKoooolIfgn)O8bogcoon?Oom_KiooOFI_3ds)KIS?o
140 "IPCKHo_W'o_gkmo3oxm3IPAgm9roo
```

Program Listing. A CoCo program to reproduce Fig. 1 (PIXCMP format).

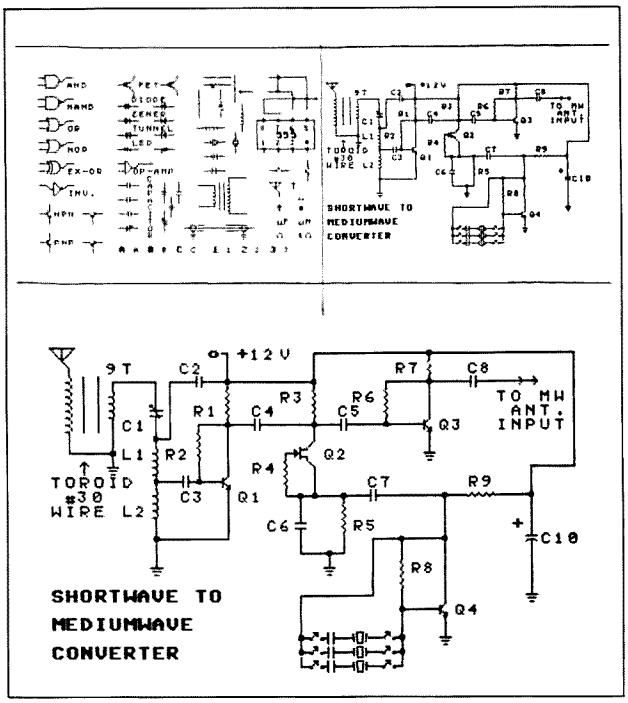


Fig. 2. The top left "screen" is a Menu screen that shows the various symbols that can be printed. The picture at the top right is an example schematic diagram. The lower picture is an enlargement of the top right picture.

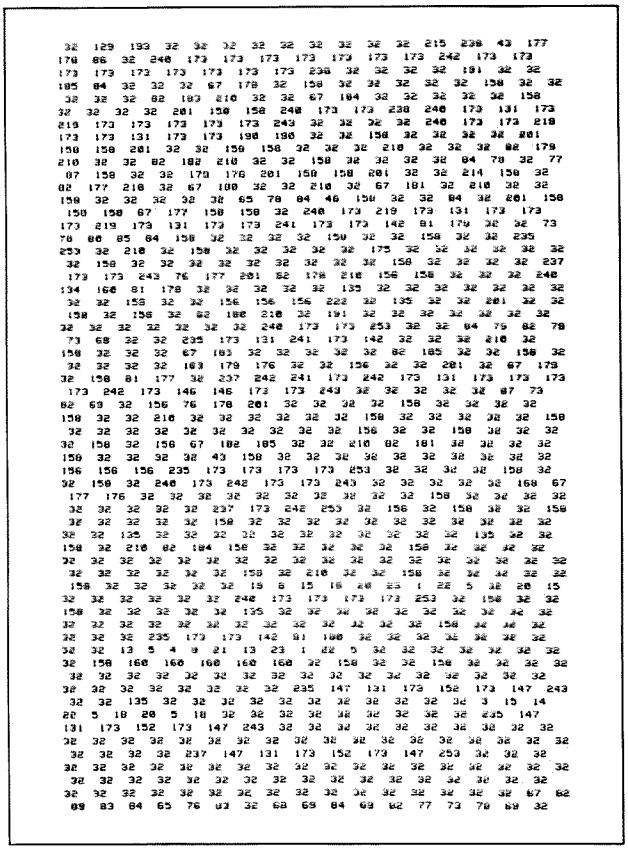


Fig. 3. List of numbers (saved as a disk file) that are transmitted via RTTY and used to reproduce the schematic drawing in Fig. 2.

ten software dependent. That is, it is the word processing software that interprets the control-P to output hard copy. The Hamsoft program probably does not have this function built in, or if it does, it is reachable by another command. I'll monitor the mail here for input from other users not reached to date and publish what I find out right here. Thanks for the interest.

Maydays from Commodores seem to be in vogue this month. Roy Hoelke KA7TTZ in Heron, Montana, tells me that he just got a Commodore C-128 computer and would like to put it onto RTTY. He wonders which of the myriad of programs to buy. Well, Roy, if sheer popularity counts, Kantronics' Hamsoft seems to be the runaway favorite. I have heard nothing specific regarding the C-128, but, if nature runs true to history, I will—just after this column sees light. If so, I shall pass along the info.

Sometimes the fruits of technology make what was once the complicated solution the simpler one. Take, for example, the problem posed by Richard Steck W9RS of Lake Forest, Illinois. Richard asks if I know of a simple, low-cost way to convert AFSK (170-Hz shift, 45.45 baud) Baudot transmission to ASCII at 110 baud. There is a station in Chicago, he relates, that transmits weather information on 147.06 MHz, and he would like to get hard copy without getting a "Baudot klunker." He adds, "I would prefer not to tie up a computer for this."

Why not? At one time, I would have recommended a hardware solution, beginning with a clock running at 45.45 baud, driving a UART to receive the output of an outboard demodulator. The output of the UART goes to a decoding matrix, on either a custom-built diode matrix or an EPROM. And the output of the code-translation chip goes to yet another UART, this one clocked at 110 baud, to output the ASCII desired. All that is left is interfacing the TTL-level ASCII to RS-232 or 20-mA loop voltages. All that is left?

But no more. While I may have a personal bias, most of you, regardless of which inexpensive computer you are attracted to, particularly the CoCo or the Commodore, should be able to put together a receive-only system—using either a software-demodulation scheme or a simple one-chip PLL demodulator as I have described here in the past—for less than $100. If you are a bit of a hacker, an old 4K CoCo can often be had for a song from computerists who have "stepped up," and it will do quite nicely. Ask around, I think that you will find it is both easier and cheaper to "tie up a computer for this" than to go through the tsoris of building a dedicated Baudot-to-ASCII converter.

Lance Miller, PhD N4LXE of Lakeland, Florida, tells me that he is "hooked" on RTTY. He tells me that he's been reading RTTY Loop for the last year or so, and the issue describing the simplicity and low expense involved in beginning RTTY really did it. He dusted off his old DX-100 and read some more columns. In another RTTY Loop he discovered how to QSY the vfo, and at the Orlando Hamfest he fell into an ASR-33, in really beautiful condition—but with no manuals, of course.

He goes on, "After almost blowing out both inguinal rings lugging the thing across the parking lot to the car, I began to have a second thought or two. The thoughts multiplied during the drive home. 'Miller, you've been out of the hobby for a long time—technology has passed you by, and you don't know a dang thing about Teletypes®!' Nevertheless, I got it into the shack, with all intercalary discs intact, and began inspecting my prize, only to discover that I *don't* know a dang thing about Teletypes. Then I recalled that old WA3AJR [old?—mil] sez in his column every month, 'Drop me a line—be sure to include an SASE.'"

Well, Lance, I am sending you some of the material that's been printed here in past issues of RTTY Loop, and I hope it helps. One of the first things I hope you learn is that most, if not all, Teletype machines break down into several pieces. I, for one, normally break one down before attempting to carry it–you may have to make more trips, but it does wonders for the back! Enjoy and good luck.

Another Teletype acquisitionee (neologiophiles, take note) is Jim Cregger KA0OZB in Jefferson City, Missouri. Jim would like to hook up a Model 33 Teletype to his TI-99/4A computer. Well, Jim, as I have covered here in the past, this should be possible with a circuit to convert the output of the computer, which is, I believe, RS-232, to the input requirements of the printer, a 20-mA loop. I am

sending you some material from old columns which may be of help. Please let us all know how you make out with this one.

Regards to Jim Walroth N3AWS, who sent along his comments regarding the TRS-80 Model 100 material published here some months ago. Jim sent his comments on CompuServe and added his wish that I publish an update of the RTTY BBS list we had here some time back. I would love to, Jim, but no one, *no one*, has sent me any updates to that information. I would not doubt that packet has taken over many earlier Baudot or ASCII BBSs, but surely there must be some new activity. I guess they are not looking for any new users. Hint, hint...

I should not have to remind my regular readers, but those of you who may be new to the magazine, having taken Wayne up on his excellent subscription offer, may be interested in some of my more mundane announcements. There is a list of reprints from old columns available. The list can be yours for a self-addressed, stamped envelope, sent to me at the address at the head of this column. I am available via E-mail on either CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR), and I do try to check into either of these every few days. Feel free to leave questions or comments to me there. If you've read the fine print in this issue you know that it is your duty, if not your obligation, to fill out the Reader Service card and to let those advertisers whose products interest you hear from you, and especially hear that you "Read About It In *73*." Not only that, but your votes and comments on the articles and columns in this issue are important, including your coments on RTTY Loop, to help give the editorial staff the feedback they need to keep *73* the vital magazine that it is.

No one has commented on the "Green Keys" question yet! Next month, I just may have to type a little about it. Who knows? The Shadow? I'll never tell. I guess you'll just have to wait for next month's RTTY Loop!■

ABOVE AND BEYOND

Number 12 on your Feedback card

Peter H. Putman KT2B
84 Burnham Road
Morris Plains NJ 07950

HERE WE GO AGAIN

You'd think I'd learned my lesson from Slide Mountain in June of 1985 (see "Just Leave Me Here To Die!" in the November, 1985, issue), but nooooo! I just HAD to climb up another peak for the September VHF QSO Party. And I just HAD to backpack everything in again, including the motorcycle battery. Some people never learn, right?

Well, I actually DID learn something from last year's DXpedition. A few things, to be exact! For starters, I was able to calculate more accurately how much weight I could carry safely, and with that figure in hand could optimize the equipment-to-weight ratio. Another lesson learned from Slide Mountain was to make my ascent in the early morning hours on Sunday, thus avoiding an overnight stay and the attendant camping equipment.

Believe me, once you've tried it, you're hooked but good. This year's expedition originally focused on Overlook Mountain, a 3,150-foot rise on the eastern edge of the Catskill Mountains near Kingston, New York. Overlook Mountain is in grid FN22 and has an excellent shot for about 200 degrees from the north to the southwest—right toward all of the activity on the East Coast.

Trouble was, I had been beaten to the punch by John Lindholm W1XX and his multi-op crew! It seems that John had been "cultivating" this site for some months now, and had finally wrangled permission to run a generator-powered multi-op station with amplifiers and big beams from the New York State Department of Environmental Conservation. John was very helpful in suggesting some alternate locations, however, and I soon decided on a promising site in FN23 called Cathead Mountain.

This would put me considerably further north, but FN23 is a relatively quiet grid and is rare on 432 and 1296 MHz, two bands I had planned on bringing along. It rises 2,425 feet in the southern Adirondacks and is accessible by a 1.25-mile trail (actually a power line right-of-way) which can get pretty steep in places! The paths to the south, east, and west looked very good, so Cathead Mountain it was going to be.

Readers will remember my trouble with my MMT-432/144 transverter last year just prior to the contest. Well, Murphy hit again and it died for good! Frantic calls by myself to ham dealers around the country (those 800 numbers are great, aren't they?) failed to turn up an Echo 70 or Yaesu FT-790. Even used ICOM 490s were unavailable! Ivars Lauzums KC2PX, who runs the PX Shack, placed a call to the Microwave Modules factory in England, wherein another i-f and final board set was located. It would come in on the next British Airways freight flight—hopefully before the contest weekend!

I set about the remainder of the station. The 144-MHz setup was my trusty TR-9000 with its impossible-to-read red LED display and 10 Watts output. The receiver is a bit suspect, so I supplemented it with one of the Microwave Modules rf-switched GaAsFET preamps courtesy of Ivars. 1296 would be run from an SSB Electronics LT-23S driven by the TR-9000. I also located a secondhand IC-502 for 50 MHz, but didn't expect a lot of performance with the 3-Watt output and quarter-wave whip. I wasn't disappointed.

220 MHz rounded out the picture with an ICOM IC-3AT barefoot. I figured on making a few contacts on FM and that was indeed the case, as most big contest stations (and not a few smaller ones) are using 223.50 MHz for their 220 contacts.

Antennas were simple: A 4-element KLM 144-MHz beam using a dipole-driven element and a 23-element F9FT Tonna yagi for 1296 MHz. I selected three pieces of 20-gauge generic antenna mast from Lashen Electronics, our local radio emporium. Mike Crawford WA2VUN helped by fabricating a lightweight antenna foot support made from a 7″-diameter piece of aluminum with a 3″ piece of 1-1/4″ pipe welded upright. Four holes were punched around the perimeter for stakes to anchor the antenna support, and the 20-gauge masting slipped over this upright piece. A slip ring and guy ropes provided support for the mast at the 10-foot level.

My brother Miles, who lives in Kingston, New York, and who is an avid outdoorsman, agreed to come along for moral support (he isn't a ham), as well as to investigate the mountain while I was operating. I located the appropriate USGS maps to aid in plotting distances worked and beam headings. We were set to leave from his house and drive north to Great Sacandaga Lake, where we would camp overnight about six miles from the trailhead. This would allow an early start.

Friday came and I was still awaiting news of the shipment from England. Too late! The British Airways flight wouldn't



Photo A. The method used to transport the antennas up the mountain. The ripstop nylon bag worked well, as the sharp 1296 elements couldn't poke through. Total pack weight was about 45 pounds.

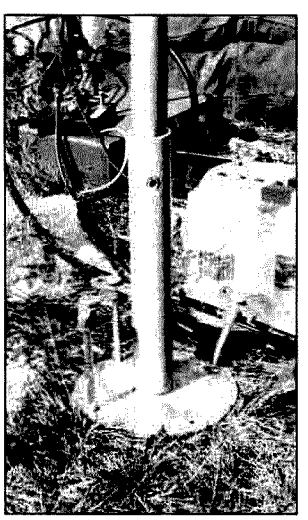


Photo B. The method used to secure the footing of the portable mast arrangement. This saved about 9 pounds from last year's tripod.



Photo C. Hard at work in a pileup (well, for a couple minutes, anyway). The 50-MHz rig is set on the calling frequency of 50.110 to listen for any DX call.

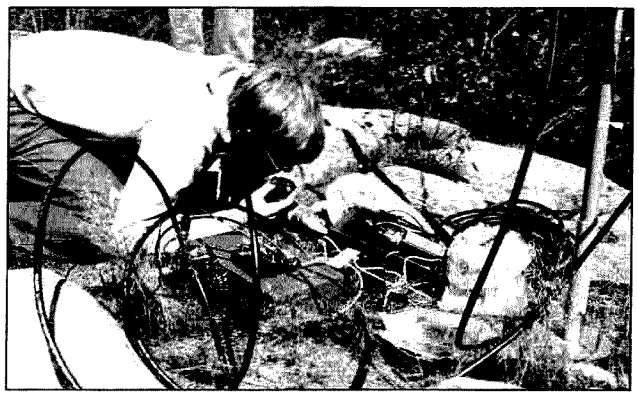


Photo D. This is how to read a red LED display in bright sunlight.

land until 4 p.m. The customs broker estimated it would take about two hours to unload the plane and have everything ready for U.S. Customs agents, which unfortunately would have left an hour earlier at 5 p.m. 432 was out! The silver lining was that my load would be that much lighter.

Saturday afternoon rolled around and I packed the car, departing at 3, an hour into the contest. Much fun was had giving grid squares out on 223.50 MHz FM from the car with my IC-37A. Mike WA2VUN (whose tower you undoubtedly read about last September) was on with a mammoth signal and I was able to track him on 220 FM simplex up the New York Thruway about 30 miles! I also got a big kick out of working W2SZ/1, who must have the strongest 220 signal I've ever heard. I gave them FN21, 32, and 22 during my trip north.

After arriving at the campsite, we plotted our strategy for the next day: Early to rise, a quick breakfast, and off to the trailhead. Of course, we hadn't figured on getting to sleep at 11:30 p.m.! The temperature dropped to below 40 degrees and it was extremely chilly when we arose the next morning at 5:30. A quick meal at the local greasy spoon in Northville and we soon found our way to the trailhead, located at the end of a dirt road.

The photos tell the story best: After taking a half-hour to load up, we set out on the trail which quickly changed from a two-lane grass road to a cleared-out right-of-way for the power lines to the ranger station and fire tower up top. This is a fairly rugged trail, crossing rocks and streams in several places. Due to the "cut swath" of the right-of-way, substantial erosion had occurred and the footing was tricky. After about an hour and 15 minutes, we had reached the top and were greeted by brilliant sunshine as well as 15–20 mph winds.

The antenna masts went together quickly, and the footing plate was installed posthaste, as were the various yagis. Several feedlines were connected, the antennas raised, and we were on the air at 10 a.m.—about an hour later than I had planned. (These things never work on schedule anyway!) Activity was thick on 144.200 and I planted myself about 144.180, looking for the folks back home who had been on for an hour already and probably thought I gave up and went home!

As you might expect, the first stations worked were the big mountaintop multi-operators, such as W2SZ/1 and W1TKZ in FN32 and FN33, respectively. After working a few locals, I heard Mike WA2VUN calling through the QRM and was able to give him his first contact with FN23 on 144 MHz. While working Mike, I was called by VE2DFO in FN25 off the back of the beam for a new multiplier, then WA2SLY in FN30 and KC2PX in FN20. This was a great location! The weather was excellent, and I can't emphasize that enough: Not a cloud for hundreds of square miles that I could see from the mountaintop (and believe me, I could see for hundreds of square miles!).

I also managed to thwart the bad luck on 1296 that had dogged me the past few years: You know—just go to a mountaintop, set up on 23 cm, and it instantly rains. Not this time, although Murphy did nail me on 432 MHz. Stations were pleading with me to go to 70 cm for FN23, and I would have loved to oblige them. Oh, well—next year, guys. W2SZ/1 actually heard my third harmonic on 432 from two meters and tried to work it! That's how good the path was between us... line of sight.

1296 operation brought six contacts in four grid squares. I sure was popular, and thought of how nice it would have been to have 10-GHz and 902-MHz equipment. 223.50 brought some more interesting QSOs, including W1VD and WA1STO in Connecticut about 100 miles distant using just the IC-3AT. I also worked my own grid on every band via WA2RQC (thanks, Otto and Doug). 50 MHz was a big flop, mostly due to the lack of a good antenna. But I did bag Steve WB2WIK on what had to be one of his more difficult contacts from FN20. Next year, 10 Watts and a three-element beam. Live and learn!

My last contacts were with John W1XX, who convinced me to come up the mountain in the first place. I worked them quickly on 6, 2, and 1296 and they were LOUD from Overlook Mountain, especially on 23 cm with a S9 +30 signal. What a location that must have been, and I can't wait to see the score they rang up.

I was visited by my stepbrother Peter Peff and his two sons from Bennington during the afternoon, as they came over to check out the climb and watch the festivities as I worked in succession northern Ontario, eastern Pennsylvania, and Cape Cod (FN41) on 2 meters. All too soon it was 2 and Miles was getting antsy, so we struck the set (after a few futile skeds on 1296 with FN43 and 42) with most of the battery power still there.

The grand totals for my effort: 60 QSOs and 28 grid squares in about four hours time. Not bad at all! If I had a decent beam on six meters and a 432 station, that total probably would have been over 100 QSOs and 40 grids for the same time interval. Next year: 10-Watt stations on all bands, plus yagis for each band and a second operator. (Maybe even 902 and 10 GHz!) Possibly even an overnight stay if I can arrange it, but I'll still backpack the stuff up to the site as always. What the heck, I could use the exercise.

Now, I just have to come up with something for the January VHF Sweepstakes.... Hmmm, how about cross-country ski portable on 6 and 2 meters from a mountaintop? Now, that would be different!■

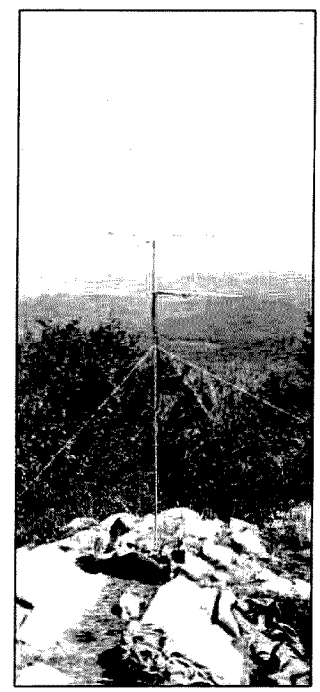


Photo E. A view from the fire tower looking east. The eastern reaches of the Adirondacks can be seen in the background. The White, Green, Catskill, and Berkshire Mountains were visible from the site.

NEVER SAY DIE

from page 14

but which the League did not. Since these are French territories, it's not out of bounds to presume they just might happen to know a bit more about the situation than the League. By the time we added up the countries accepted by all of the IARU societies we had 396. Yep, almost 400 bona fide countries.

396 beats the hell out of 325 or whatever the League is buying these days, so starting in January, 1987, we'll have a new DX country award available from *73*. The award starts with 100 countries, with stickers for 200, 250, 300, 350, 360, 370, 380, 390. . . and yes, 396. It's not beyond possibility that there'll be a few more added, bringing us over the 400 mark. . . I hope so. When it comes to working countries, the more the merrier, so why be stingy?

Yes, we want to see the QSL cards confirming the contacts. Hey, remember that I'm not new to this DX award business—I started the WPX award and a bunch more, so don't screw around with any fake cards. One fake card and your name is mud. I work enough DX so I know what's out there and have many of the cards myself, so I can spot ringers. Please try to remember this whole thing is for fun. . . and what's the fun if you cheat?

In addition to the all-mode award, I'll have special awards for working 100 countries on several modes—two-way RTTY, SSTV, packet, AMTOR, high-speed automated CW, and mobile one way. . . again with stickers for additional countries. That ought to keep you busy.

All contacts must be made after 0000 UTC, January 1, 1987. I'm planning on running a picture of the first winner of the award on the cover of *73*, so let's see how long it takes. It doesn't take very long for a DXer with the time to whup off a hundred countries—I've done it in a single weekend on SSB. Yes, of course it was during a DX contest, but it still was a big challenge and I made my one-hundredth just minutes before the contest ended. Did it all on 20m sideband.

One time when the band conditions were good I set up a new ham station and got to work on DX. It took me a week to get 100 countries, a month for 200, and a year for 300. That's about par unless you haven't much else to do. . . a situation I haven't enjoyed since I got into publishing 35 years ago. There's nothing like a monthly publishing deadline to keep you busy the rest of your life.

We'll be publishing the scores in *73* so you'll know what you're up against. Is there any reason I can't ask you to send in computer printouts of your award progress along with your cards?

I suppose I shouldn't mention that I'll have stickers for single-band awards, making it possible for you to get up to 396 countries on as many different bands as you want. The minimum award is for one hundred countries per band. That's duck soup on some bands, but a definite hurdle on 160, for instance.

Will the special mode awards encourage DXpeditions to take along RTTY and other special mode gear? I hope so. It'll also keep 'em busy a few more days as they work 10,000 stations on eight bands with six modes per band. Let's see, that's 480,000 contacts. That could take well over a week. If the DXer works two contacts per minute 24 hours a day, it would take 167 days to get done—that's figuring good propagation all the time. But 10,000 won't even begin to peel off the first layer of Japanese DXers, much less get to the U.S. and Europe. Oh well, look on the bright side, if everyone puts a Green QSL in their envelope you'll be able to retire with a half million dollars. Is there a serious shortage of hams who will work 167 days for a half mil? I can just see the DXpeditions sprouting.

To make your DX hunting a little more fun, I've had the *73* art department put together a world DX map which shows the 396 countries. I always thought the old *Radio* magazine DX map was the best I'd ever seen. It was black and white so I could mark the countries with a colored pencil when I worked 'em. I put 'em in pink when I contact 'em and solid red when the QSL arrives. Those confounded maps in color don't let you show what you've contacted as easily. Map pins aren't as much fun as coloring. Here's where your college course in Map Coloring 202 will stand you in good stead.

How many CBers does it take to hunt elephants? 51. One to carry the guns and 50 for the decoy. That was originally a Polish joke, but I'd rather offend CBers.

Okay?

QSL DESIGN CONTEST

Getting any new project going is usually difficult at best, so I have been hoping we'd not screw up the early customers for our QSLs too badly. Several years ago I converted the garage in our old Pine Street building into a print shop. I put in a couple fair sized presses so I could put out amateur radio books without being a prisoner of a local printer.

"I've done the designs we've used so far, so it's about time for you to take some responsibility. You design our next card."

It takes quite a bit of equipment to do this—plate makers, a couple offset presses, a power paper cutter, a folding machine, an inserter, and a stitcher to put in the staples. I bought everything second- to tenth-hand, so my investment was fairly modest for the print shop I put together.

When I sold everything three years ago all the print shop equipment went with it. Fine, that gave me an opportunity to start over and put together a new print shop using brand new equipment, sparing no expense. My WGE print shop (Peterborough Press) has a large four-color sheet-fed offset press for printing full-color brochures and booklets, a four-color web offset for direct-mail letters, an envelope press, plus the usual bindery equipment—a half-million-dollar investment, all told.

I started printing QSL cards many years ago as a way to keep my book presses busy in between major jobs. I explained in my ads that the prices were low because the QSLs did not have priority on press time. It was a way to provide first-class, yet inexpensive cards, priced so we wouldn't lose too much on the deal. They were a great success.

I had one design with a blue photo of the world taken from space. We were able to print large sheets of these ahead during slack press times. The back of the card had a simple report form—with everything essential for DX-CC credit. It, too, was printed ahead when we had the time to spare. That left only the name and address to be put on the front in black, ganged up 16 at a time. Even when we were busy printing books we were usually able to work in some QSL fronts so orders wouldn't have to wait too long.

The key to keeping QSL prices low is being able to make them in large quantities and to automate as much of the process as possible. By printing two out of the three impressions ahead when the press time was the least expensive we were able to cut costs. By printing them in large sheets instead of one at a time, the way most QSL printers do, again we cut costs.

We set the type on our typesetting system so all we had to do was shoot it into negative form and paste it into the flat, ready to make the printing plate. We'd print the cards 250 at a time, so if someone wanted 500 cards we'd print two cards—1,000 cards meant four at a time. Then, when the printing was dry, we'd cut the cards, box 'em and ship 'em by UPS.

We're using the same system again, with the name, call, and address set by our new computer typesetting system. This one even puts the type in the right position on the card, saving a paste-up step—and a few minutes work.

We started out with some of the same designs I used several years ago—nice cards. We've been getting lots of great letters from readers who've ordered the cards and like 'em. Despite a heavy work load in our print shop we've been getting the cards out in a surprisingly short time. I've explained to my people that when readers order something by mail they somehow expect it to arrive the next day—so if we want repeat business we'd better give the best service we can.

Which brings me to my point—I eventually get around to my point, it's just that I digress a lot. By the way, "a lot" is two words. I don't know how many readers write to me spelling it "alot"—there is no such word. Allot, yes, but that's a different word. Hmmm, another digression! Oh, yes, my point. . . well, it seems to me it's getting way past time for us to have a new

QSL card design. I've done the designs we've used so far, so it's about time for you to take some responsibility. You design our next card.

Sigh, I suppose just plain glory and fame aren't enough for you. Crass capitalist that you are, I can see you sitting there thinking big bucks. Look, I already said I'm trying to provide the lowest cost QSL cards I can, so get visions of sugar plums out of your mind. No, what I thought might be nice would be a lousy $100 prize for the card design I like best—and maybe $50 for the second best. Let's see what you can do.

Remember, QSL cards have to be a fixed size as required by the post office, so don't get into any poster-sized extravaganzas. The front can be any two colors you like—the back one color. We'll have to print the call and name/address on the front of the card for economical reasons.

Entries should be in my hands by January 31, 1987 (*73* Magazine, QSL Design Contest, WGE Center, Peterborough NH 03458). The quality of the idea is more important than the artwork itself. I've got some superb artists here who can do almost anything. Neatness does count though. Try to remember to put your own name/address on your entry.

Another card I came up with a few years ago had the call in as large letters as possible—the idea being that when hams put your card on their wall it will stand out from all the others. It's a real kick when you see a picture of a DX station and there is your card! The normal small call letters get lost on a shack wall.

When I first got into amateur radio every ham not only had QSL cards, they sent QSLs to confirm every new contact—even on 160m. I think someone would have a heart attack these days if they got a QSL for a two-meter repeater contact. That's sad, really, because it's nice to have a chap's card in your hand when you're talking with him—even if it's over a repeater. Cards are a nice way to keep track of friends.

I remember the time twenty years ago when I visited VK6RU in Perth and he pulled my QSL card out of his file—from a contact twenty years before that! Twenty years! I've got to get down and visit Australia again. . .that's much too long to stay away. You know, I found an old file of mine—a detailed log of my African safari and around-the-world trip twenty years ago and all the interesting hams and places I visited. I printed some of it in *73* at the time, but most of it never got into print. Should I dig some out and see if it's still fun to read after twenty years?

Getting back to QSLs, with QSL bureaus, much of the postage curse is eased. If you work DX you have to have cards. If you're into any special modes it's pretty rotten not to QSL. This will be even more critical as my new DX award takes hold, with certificates for working countries on automated high-speed CW, RTTY, packet, SSTV, and so on.

One more thing—if you order QSLs from us please be very careful in writing your name, call, and address. If you scribble and we read anything wrong, will you really expect us to make a new batch for nothing? We try to check and recheck, but that won't help if you've made a mess on your order blank.

Now, let's see what you can come up with for a new *73* QSL design.

SOMETHING YOU CAN DO!

Many of you are frustrated about the dwindling number of newcomers to our hobby and have been asking what you can do personally to help the situation.

Our most serious loss has been in the number of youngsters entering the hobby—it's dropped from about 75% to under 15%. Indeed, this loss of youngsters accounts a good deal for the catastrophic drop in new hams we've experienced over the last twenty years.

If we want to get kids interested in hamming we have to reach them—through school radio clubs—and through ham magazines in school libraries. You and your local ham club can sponsor a school radio club and help it get started. Getting a ham magazine into the school library is something you can do personally—a way to help pay your dues to your hobby, so to speak.

While I admit to a slight bias in this, let's look at it practically—if you were going to try and get some kids interested in amateur radio, which ham magazine would you give them to read? Would it be *QST*, with its acres of activity reports? *CQ* with contest news? *HR* with articles on how to build a 10-band all-mode transceiver? Or *73*, which will be running a Novice/Technician license study course? Sure, I loaded the question, but I didn't exaggerate much and you know it.

If you'll sponsor a subscription to *73* for a local school library, I'll go part way with you—making it available at less than our cost—$15 per year in the U.S. That's a 40% discount from the regular $25 subscription price! Here's your chance to get an interesting ham magazine out where the kids will have a chance to read it. This could make it much easier to get school radio clubs going.

I'll do my bit in *73* with plenty of simple construction projects to get 'em started building—articles on every new aspect of our hobby—and a simple technical home-study course in electronics.

For the cost of a dinner you can be a local hero—and your gift just might help some youngster get into amateur radio—and then into electronics or communications as a career. You won't find a cheaper way to have a profound effect on young lives—or to help your hobby.

Amateur radio has provided you with a lot of fun over the years—isn't it time you started helping us attract youngsters in repayment? Please send me the name and address of the school you wish to endow with a subscription to *73* and I'll see they get it with a note that it is a gift from you. At $15 a year, we lose a little money on each subscription, so we're backing you the best we can. . .without going broke in the process—which would benefit no one. ■

SPECIAL EVENTS

XMASTIME AWARD
DEC 1–31

The Hen House Gang will be sending out the Christmastime Bethlehem and Santa Award during the month of December. Operation is on 10m, 20m, 40m, and Novice CW. For the Santa envelope and fold-up card, send a first-class stamp only; envelopes will be provided. For more information, write to the club president, Robert J. O'Neil W1FHP, Hard Hill Road, Bethlehem CT 06751.

FARIBAULT MN
DEC 6

The annual Handi-Ham Winter Hamfest will be held on December 6 at the Eagles Club in Faribault, Minnesota. Registration begins at 9 a.m. Talk-in on .19/.79. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

HAZEL PARK MI
DEC 7

The Hazel Park ARC will hold its 21st annual Swap and Shop on December 7 at the Hazel Park High School, 23400 Hughes. North of 9-Mile, west of Dequinder. General admission is $2 in advance, $3 at the door. Children under 11 free. Tables $1 per foot. Talk-in from the 9-Mile and I-75 area on 146.52. For tickets and table reservations, write to HPARC, PO Box 368, Hazel Park MI 48030.

LYNCHBURG 200TH
DEC 13

The Piedmont ARA will operate special-event station AA4UM on December 13 from 8 a.m. to 8 p.m. to celebrate the 200th birthday of the city of Lynchburg, Virginia. From 8 a.m. until noon the frequency will be 3.855, and from noon until 8 p.m. it will be 14.302. For a commemorative certificate, send QSL and an SASE to Piedmont ARA, PO Box 11362, Lynchburg VA 24506.

CLARK COUNTY EVENT
DEC 13–14

The Clark County ARC of Bethlehem, Indiana, will operate W9WWI/9 from 1700 to 0300 UTC on December 13 and from 1300 to 2000 UTC on December 14. Frequencies: 3.905, 7.240, 14.290, 21.365, and 146.25/.85. For a certificate, send a large SASE to CCARC, Box 532, Jeffersonville IN 47131.

CHRISTMAS TOY TEST
DEC 27

The Piano Amateur Radio Klub will operate special-event station WQ5S—"Christmas Toy Test"—from Plano in Collin County, Texas, beginning at 1600 UTC on December 27 and ending 24 hours later. The idea behind this event is to give "new Christmas toy" owners an opportunity to try out their rigs/accessories. Look for station operation on the following bands: the center of the Novice bands ±QRM; the lower 25 kHz of the General phone bands ±QRM; and 146.52, 52.525, and 29.600 MHz FM, along with 144.200 SSB. QSL via Brad Fuller WQ5S, Rte. 11, Box 24, McKinney TX 75069.

MICHIGAN 150TH
JAN 25

The Oakland County ARS will operate W8TNO on January 25, from 1600 to 0000 UTC, to celebrate the 150th anniversary of the state of Michigan. Operation will be on 20 to 80 meters SSB and CW. Suggested frequencies are 14.270, 7.270, 3.870; CW—7.130 and 3.730. For a special certificate, send a 9 x 12 SASE to W8TNO.

73 INTERNATIONAL

Number 25 on your Feedback card

NOTES FROM FN42

As the holidays approach, greetings fill the air: Merry Christmas! Happy New Year! Happy Chanukah! And to those of you who celebrate these events on December 25th, January 1, and December 27th, respectively, we of *73 Amateur Radio* wish you much merriment, happiness, and reasons to be thankful. Since this is "*73* International," we also extend best wishes for Chanukah to Israel, for Ethiopian Christmas (January 7), Boxing Day (December 26, Canada and Great Britain), Happy New Year's Holiday to Scotland (Jan. 2), Happy Year of the Rabbit to China (year 4624, Jan. 29), and Happy Independence Day to Bahrain (Dec. 16), Burma (Jan. 4), and Nauru (Jan. 31). Apologies to any whose nation has a major holiday not listed here; we could only do our best. When you work 4X or 4Z, ET, VE, G, B, A9, XZ, or C2 on or near the appropriate days, send your best wishes, too. Be the first non-Bahraini to send special greetings for December 16. . . you'll probably be given the keys to Manama—and maybe a temporary license to operate, and A92BW will have to take back his words, "There is absolutely *no chance* of visitors obtaining a license. . . . " Stranger things have happened as results of friendly, thoughtful geetings.

It isn't too late to wish a happy 80th anniversary of its sovereignty to Liechtenstein, either. . . see news about HB0 below.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

FOR SALE—OR WANTED

The DOC has approved VK3's proposed advertising of amateur radio equipment for sale or wanted on the weekly WIA Sunday broadcasts. VK3 now joins VK5 and VK6, which have similar activity. It will be strictly controlled: no prices to be used, and all adverts must be screened competently. Des Clarke VK3DES,State Secretary, has taken on the task. Requests must go to him in the VK3 Division office by each Thursday; if approved they are aired Sunday, and any interested listener can contact him and receive the phone number of the person who placed the ad.

The Sunday broadcast is transmitted over several bands simultaneously and thus covers much of Australia, New Zealand, and some Pacific islands (propagation permitting).

TRAINS AND AMATEURS

I did not realize how popular amateur radio was with railway workers or enthusiasts until the feedback started after my column on "VK5 Amateurs Go Rail Mobile" [*73* International, March and April, 1986]. I received many letters from various countries and, from Heinze DJ3UN, even an international callbook of amateurs belonging to FIRAC (Federation Internationale des Radioamateurs–Cheminots). So: here is more on the subject, from Graham Horlin-Smith VK5AQZ, J150/Amateur Radio Celebration's coordinator.

WHISTLE STOPS WITH AMATEUR RADIO

VK5JSA's most recent activity has been to work from the Jubilee Industry Trade Train, which enjoyed a three-month successful run, presenting amateur radio and news of South Australia's Jubilee Year to community groups, amateurs throughout Australia, and the lucky DX stations that were able to catch it.

The travelling showplace consisted of nine diesel-hauled modern carriages including (1) a VIP entertainment car, (2) a power-equipped carriage to supply the total requirements of the train at 20 different whistle stops, plus a week at the beginning and in Adelaide at the end, and (3) a Communications Centre breakvan (15' x 9') at the end of Carriage Seven (home for the VK5JSA S.A. radio amateur volunteers for the three-month trip), with space for static displays of amateur radio materials, HF and 2-metre stations, two operators, and a stream of visitors.



The Wallaroo whistle-stop ops. From the left: Doug VK5NIY, John VK5BL, Andy VK5NTT, Wally VK5NWA, Norm VK5HL, and Lloyd VK5LL. "Wallaroo" is the aboriginal word for. . . well, discreetly ask the next Aussie you meet. (Photo by VK5NTT)



Russell VK5KAK, Geoff VK5PXK, and Ron VK5ARC, Noarlunga Centre amateurs. (Photo by Graham VK5AQZ)

Among a distinguished group of volunteers and workers were several whose solo efforts are worth a mention. Jack VK5FV was our Man Friday who slipped out of Adelaide to activate the station at Lameroo (with Les VK5LH) and at Burra. Terry VK5ATN looked after Balaklava and Riverton. The displays were professionally accomplished by Peter Koen (the display engineer of the Trans Australian, "Live Across The Nullarbor"). And at each whistle stop a team of fresh, local amateurs took over VK5JSA/Portable, which resembled a sort of radio marathon across VK5-land (which is 1-1/2 Texas' size).

Activating VK5JSA at each stop meant installing a pre-set five-band trapped vertical, which was clamped to an external passenger handrail and swung outwards, allowing about a two-foot clearance from the train. The use of the 2-metre rig depended on the proximity of the nearest repeater.

•Over 5,000 contacts were logged, with a high percentage of Jubilee 150 QSLs confirming the Trade Train contact.

•Propagation limitations made contacts on 20, 15, and 10 metres difficult—as did some operating locations.

•VK5JSA was well received nightly on 80 metres by Australian stations calling in, and the J150 nets were further boosted whenever the Trade Train appeared on the net frequency.

•The three-month program for VK5JSA enabled stations to catch the train and collect points for the Jubilee 150 Award, with VK5JSA and VK5 contacts. As of July 1st, the Jubilee callsign changed to V15JSA, and DX stations were invited to qualify for the award as follows: one contact with V15JSA *or* five with V15s for the Bronze Award, one with V15JSA *plus* five with V15s for the Silver Award, and, for the Gold Award, by meeting the qualifications published (or to be published) in American amateur radio magazines.

NOTE: Australian and DX recipients of J150 Awards have been made "Honorary VK5s" to assist other DX stations to qualify for the award. (Certificated stations are worth 15, 30, or 50 points, plus band points, for triple-certificate holders, towards the 150 points needed for the very popular South Australian Award.)

There now is a rumor that we might even put V15JSA on board a Formula 1 racing car in this month's [October] "Grand Prix," from the Adelaide circuit!

AUSSIE YLs

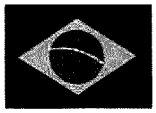
Without doubt, two ladies stand out as amateur radio pioneers, particularly within VK.

The first was Mrs. Florence McKenzie VK2FV, first licensed as 2GA in 1921. "Mrs. Mac" was known to countless thousands of American and other Allied servicemen during WWII due to the Morse code lessons she gave in Sydney (VK2) during that trying period. A Silent Key since 1982, her memory is perpetuated by The Florence McKenzie Award instigated by the ladies of ALARA (Australian Ladies' Amateur Radio Association).

The second OOT/YL is Austine VK3YL, the first YL into the Royal Australian Airforce Reserves and the only Australian YL to achieve the DXCC honor roll. She also is remembered for performing a similar service as CW instructor, but in Melbourne (VK3). She is the oldest registered member of the WIA, with more than 54 years of continuous membership.

Of latter days, two ladies come to mind as outstanding contributors to our hobby, Heather VK2HD and Jenny VK5ANW. VK2HD is a regular net controller on 14.220 at 0600 UTC, and was recently appointed as a director of the YASME Foundation managing board. Jenny is the State Representative of, and Australian Secretary of, ALARA, and also is State Secretary of the WIA.

In a future column I will tell you more about ALARA, which is worldwide with a membership of around 200. Meanwhile, if you are interested in joining, write the ALARA Treasurer, PO Box 4, Middle Brighton, Australia 3186; listen in to members of YL clubs around the world meeting on the sixth of each month, on the hour (with 0400 UTC and on being most popular): *Phone:* 3.588, 14.288, 21.188, 21.388, 28.588, 28.688 *CW:* 3.530, 14.058, 21.058, 21.133, 28.058, 28.133.



BRAZIL

Gerson Rissin PY1APS/PY7APS
PO Box 12178, Copacabana
20000 Rio de Janeiro, RJ
Brazil

Carlos Vianna Carneiro PYICC
Afonso Pena, 49/701
20270 Rio de Janeiro
Brazil

TRINDADE ISLAND

Trindade Island, Fernando de Noronha, and St. Peter & St. Paul Rocks are three rare spots that belong to Brazil, but due to their distances from the coast they count as separate countries for the DXCC award. So every DXpedition to those islands is an eagerly anticipated event. Each time, many friends are able to work a new one or sometimes a new country on a particular band or mode. It was the same during the last DXpedition to Trindade Island.

The Brazilian navy supplies the island every two months and usually authorizes the trip of one or two amateurs. This time, Claudio PY1DFF and Ric PY1VOY were ready to go after making a few arrangements. First they got a four-band vertical antenna, model DXV-4, from Electril, two more verticals for 20 and 15 metres, and a longwire for 80 and 160.

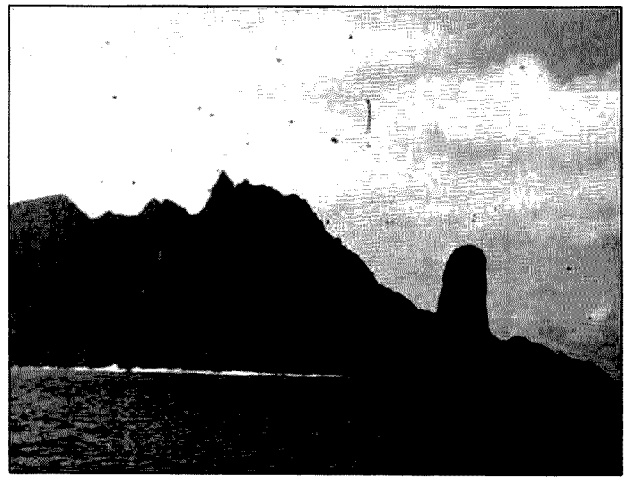
After five days, the ship finally arrived off Trindade Island. Immediately, the ship commander ordered the helicopter to land the people and equipment. The DX team decided to stay in the Meteorological Station, and within 15 minutes the DXV-4 was up and ready.

After the very first QSO, the pileup was tremendous, and the operators took turns operating during the entire day in spite of poor propagation on the high bands. At night the conditions were excellent for Europe, Asia, and North America on the 7-MHz band. During the split-time operation on 7.001, the pileup was very strong between 7.003 and 7.010. At 0700 UTC in the ZL2AAG net, it is possible to work many Pacific-area stations.

After 16 hours, 1,285 stations were worked, most of them on 40. (QSL information: PO Box 90415, 25600 Petropolis, RJ, Brazil.)



The DXpedition team: Claudio (left) and Ric.



Trindade Island.



Dulce PY1BUL receives GPCW winner's trophy from GPCW manager, PY1JN.

PY1DFF/PY0T and PY1VOY/PY0 are grateful to the Brazilian Navy and the commander of the *Gracia Aranha* for making their DXpedition possible.

de PY1APS/PY7APS

WORLD'S 1ST EHSC YL

Several CW high-speed clubs exist, like the famous FOC (Finest Operators Club), like TOPS, and like the HSC series: High Speed Club, Very High Speed Club (VHSC), Super High Speed Club (SHSC), and Extremely High Speed Club (EHSC). Membership in each requires a 30-minute operating period (normal conversation) receiving and sending at 25 to 30 wpm for the first category, 40 wpm for the second, 50 wpm for the third, and 60 wpm for the EHSC level. No computers, decodifiers, or keyboards are allowed during any operating. Five HSC members must QSL the candidate for HSC membership, four VHSC QSLs are needed for that level, three for SHSC candidates, and two sponsors are required for EHSC.

Brazilian YL Dulce PY1BUL became the 1,370th member of HSC, the 213th of VHSC—and the 3rd YL in the world—the 88th of SHSC (and the second YL), and member #46 and the *first* YL member of EHSC. Hers is also the first Brazilian station to earn that honor! If you would like to chat with Dulce, you may do so in English, French, German, Italian, Portuguese, or Spanish!

We are proud of our PY1BUL! And according to her, pretty soon we will have another Brazilian EHSC member—Alex PR7PO. (He and Harold PY1ZAE are the only active Brazilian members of the FOC at this time.)

de PY1CC



GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill
Camberley GU17 9JQ
England

The involvement that the RSGB (Radio Society of Great Britain) has in the affairs of amateur radio in the UK never ceases to amaze me. Not that I would like any *73* subscribers to read anything derogatory into that remark. The RSGB does a very good job and represents UK amateurs very, very well. Witness just two recent RSGB successes—the opening of 50 MHz and the opening of Morse on the air to Class B (VHF only) operation.

No, what amazes me is the extent to which RSGB is involved with all aspects of amateur radio—technical, regulatory, operating, awards, representation on official bodies, and many more. Among RSGB's specific activities: rally organization, special-event callsign allocation, publication of *Rad Com*, slow Morse transmissions, beacons and repeaters, GB2RS news broadcasts, film and tape library, QSL Bureau, reciprocal licensing, equipment insurance, intruder watch, and propagation studies.

All of this is in addition to the general promotion of amateur radio as envisioned by the society's objectives (my paraphrasing):

•To promote the general advancement of the science and practice of radio communications.
•To facilitate the exchange of ideas and information on the subjects amongst members and others.
•To obtain the maximum freedom of action for amateurs consistent with safeguarding the interests of all concerned.

The affairs of the society are organized and directed by its Council, chaired by the president and including the immediate past president, the executive vice-president (who becomes president in the following year), the "Honorary Treasurer" (responsible for the all-important funds), and up to 15 members elected annually by postal balloting amongst all voting members of the society.

A society like the RSGB exists both to serve and be served by its members. This necessitates a continuing *two-way* flow of information, ideas, and opinions. Some 20 Regional Representatives interface between the Council and more than 100 Area Representatives. Their areas of responsibility may be as large geographically as northern Scotland or as large numerically as Greater London. The area representatives look after smaller geographic areas containing up to 20 or so different local radio clubs; they are the ones who best know and understand views at the grass-roots level, often being current or past officers of a local club.

A significant element of the work of the society is entrusted to its 16 standing committees and its management group. These are on: Education, Electromagnetic Compatibility, Finance and Staff, Exhibition and Rally, HF, HF Contests, IARU, Licensing Advisory, Membership and Representation, Microwave, Propagation Studies, Raynet, Repeater Management, Technical and Publications, VHF, and VHF Contests. Attached to the committees are a number of Honorary Officers charged with coordinating or managing particular aspects of the society's work.

All of these posts are voluntary, of course, as are the society's representatives on seven British Standards Institute committees and five CCIR study groups. It is the continuing desire of so many to offer their time and energy to help the society achieve its objectives that is in no small part responsible for the excellent state of and high regard for amateur radio in the UK.



INDIA

Ajitaprasad Ramesh VU2RAH/W7
1025 E. Orange, G25A
Tempe AZ 85281

GARDEN CITY CONTEST

The Bangalore Amateur Radio Club (BARC) and the Vivesvaraya Industrial & Technical Museum (Bangalore) announce the 1986 Garden City Contest on CW (between 1200 UTC Saturday, December 13 and 1200 UTC Sunday, December 14) and phone (1200 UTC Saturday, December 20 and 1200 UTC Sunday, December 21).

•There is no entry fee. Open to all licensed amateurs worldwide; single operator only, power and frequency restrictions as per stipulations in the contestant's license.
•80, 40, 20, 15, 10 meters; contact may be made with the same station once in each band.
•Exchange: Complete RST report and contact number in three or more digits—e.g., if VU2ABC is your first contact, your report would be 599001; if VU2XYZ is your 20th contact, your report would be 559020.
•Entry classes: A for VU2s with Grade 1 license; B for VU2s with Grade 2 license; no designation for all non-VU2 hams.
•Points: For VU2s, complete contacts, Asia, including India, 1 point; Europe, Africa, Australia, 2; North and South America, 3. For DX stations, Asian, 1 point for every VU2 contact; 2 points for European, African, and Australian stations; 3 points for stations in North and South America.

Entries must be postmarked January 15, 1987 or before, and addressed to The Convenor, Garden City Contest 1986, Bangalore Amateur Radio Club, PO Box 5053, Bangalore 560001, India.

Winning certificates will be awarded the three top scorers in each class; all contestants submitting logs will receive certificates of participation, also (n−1)th place winner will be awarded in each group (where n is the total number of entries received).

Rulings of the contest committee (nominated members of BARC and VITM) will be binding and final; contest not open to employees of the National Council of Science Museums or BARC members who receive, scrutinize, and evaluate entries, and recommend the awards.

For further information, write VU2RAH/W7 at above Arizona address or phone him at (602)-921-0145.



LIECHTENSTEIN

Guenther Erich Holzknecht
HB0CZS, Secretary
Liechtenstein Amateur Radio Association
PO Box 103, FL-9493 Mauren
Principality of Liechtenstein

The Liechtenstein Amateur Radio Association (LARA) has been formed for the hams and SWLs of the Principality, and IARU membership has been applied for. Until now, Swiss operators have determined amateur activity in the country and could change their HB9 calls into HB0 calls when visiting. One result was that as many as 200 HB0 stations were on the air during a single weekend. From now on, all non-Liechtensteiners must put HB0 in front of their own callsigns.

There are 11 resident operators in Liechtenstein, five with shortwave licenses, and they are active on all bands. There is a club station (HB0FL—the FL standing for Furstentum Liechtenstein), a repeater has been set up, and LARA has established the 1.Liechtenstein Award. "We like OSLing and enjoy DXing as well as rag-chewing. For us it's always a pleasure to talk to Americans and we hope to meet as many operators [from there] as possible."

Thanks to George Baustert AA4VB, VP, Florida Westcoast DX Ring, for this information.



NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

I have been absent from these pages since June holidaying in the U.S. and Canada. We are very lucky people, belonging to such an international fraternity as amateur radio. Everywhere I went I was immediately among friends. The hospitality was overwhelming.

I have many happy and memorable times to look back on, from the Irish KA6 I worked pedestrian mobile in Victoria, B.C., who was sure he knew me (he reads this column—at least I have one reader!), the Hamfest group at Jackson's Mill, West Virginia, the Prince Edward Island gang and the breakfast meeting, the Amsterdam [New York] stopover with a ham family (Mum, Dad, and all three daughters are hams) and the visit they took me on to the Antique Wireless Association Museum where I met the curator, Bruce W2ICE, and all the others I met for an "eyeball" or on-air QSO. I even visited the Doghouse Restaurant in Seattle, where a back room is reserved for ham operators to have their lunch away

from the main eating room, and met some of the local amateurs.

I was especially fortunate to meet with Wayne W2NSD (and his two beautiful greyhounds), managing editor Chris KA1MPL, and many of the *73* staff when I stopped over in Hancock, which is a delightful New Hampshire town. What a marvelous environment to have as a work place! It must be a pleasure to go to work each day! [*We enjoyed having you visit us! Come again! —International Editor*]

Another experience to be remembered was the chance to assist at the EXPO Amateur Station and Display in Canada Place, in Vancouver. Unfortunately, only my host, Jack VE7CMD, and I were there for the Friday evening 5–10 p.m. period, and we were so busy answering visitors' questions that there was little time to operate VE7EXPO, but at least I did log a couple of contacts on two meters. The VE7EXPO QSL card is a wonderful memento of this occasion.

While in Vancouver I had the use of VE7CMD's equipment and logged many fine QSOs, finished off my Worked All States portable VE7, and now await QSLs only from North Dakota, Rhode Island, and Wyoming to place my application for the award.

I must also mention the assistance I received from some of the great nets operating in North America: the YL Net, the Century Club Net, and the Rocky Mountain (Hi Noon) Net, just to name three. All net controllers made me very welcome, helped me when they could, and made my days on the air much more enjoyable and memorable.

NZART'S 60TH

Much went on while I was away and it was still going on when I returned. August 16th was the 60th anniversary of The New Zealand Association of Radio Transmitters; the still-active Tom Clarkson was honored as a founder member and received a plaque from NZART President Terry Carrel ZL3QL; a special callsign has been allocated to NZART's HQ station, ZL6A, which will be operating on all bands (conditions permitting)—and there will be a special QSL card; and a Harkness Fellowship has been awarded to Dr. Murray Milner ZL2LB to study for up to two years in the U.S. and bring back knowledge and experience to help in the planning of New Zealand satellite communications.

Radio masts and antennae and town planning were also to the fore during my holiday absence and another favourable decision made. . . I attended a forum on this subject while in the States so it is apparent that the problem is worldwide; we must be constantly vigilant when town planning and amateur radio matters are being discussed to see that our rights are defended.

In my next column I will cover our new Radio Regulations, which became effective in July after two years of consideration by ZL amateurs, with whom our regulatory body, the New Zealand Post Office, kept in touch.



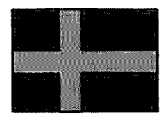
POLAND

Jerzy Szymczak
78–200 Bialogard
Buczka 2/3
Poland

Jurek Prajsner SP5NZ/MM travelled with the Polish passenger vessel *Stefan Batory* on a Caribbean voyage from February 13 to March 20. He used FT-790R and FT-290 Yaesu transceivers with 30-W amplifiers, and attached yagis to a bulwark rail, 12 element for the 70-cm band and 5 element for 2 metres, with a 7-metre antenna feeder cable. It was difficult to establish contact with Caribbean region hams for converters there work on 146–147 MHz, and most hams there speak only Spanish. SP5NZP/MM signals made a hit off the coast of Great Britain and BRD through 70-cm converters, too. He made 40 QSLs through OSCAR 10 when outside the range of local stations. His most interesting communications were with "KA1MLN—operator Ester from Boston, W1QXX—operator Jack, LU8EBH—operator Col, and CT3BI—operator Jose."

The ham student club SP9PDF from Gliwice went to the Aland Islands in 1984 [*see Sweden column for more Aland activity*]. SP6LHI, SP6BGB, and SP9FIH operated at 20° longitude and 60° latitude with FT-101Z and antenna W3DZZ. On July 24th at 2100 UTC they began to call on 14.195 MHz and other bands using antennas 14 AVQ, TH3MK3, and 402 BA. On weekends they repeatedly exceeded 130 QSOs per hour; 7,100 contacts with stations in 116 countries were made in 10 days, including 720 QSOs with Poland. Solar activity held contacts with the U.S. to 75; 250 with Japan. They made a hit with contacts on 80 with ZP5JAL and AP2SA. They much appreciated the hospitality they received from Finnish hams.

Polish DX Contest winners (countries confirmed/accepted countries), CW: SP6RT 314/334; Phone: SP9VU 312/324; Mixed: SP7HT 316/339. There are some rule changes for the SPDX Contest for April, 1987 (SSB; the contest is CW in even-numbered years), which will be published here next time.



SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S–155 00 Nykvarn
Sweden

Enthusiastic and active YLs in Finland and Sweden arranged a DH/SM YL meeting on "neutral soil" last May. Raija SMØHNV/OH1RL, who has been to YL meetings around the world, decided it would be great to have an annual Scandinavian YL get-together, and with the Finnish YL group, organized the first one on the island of Aland—OHØ-land. [Aland is a group of islands in the Gulf of Bothnia—an autonomous department, 25 miles from Sweden and 15 from the Finnish mainland.]

Lars OHØRJ kindly lent his FT-757GX and a multiband dipole, and arranged for the club call—OHØAB (Anna Bella) to be used. Several hundred QSOs were made despite the beautiful weather; such a prefix used by YL operators stirred up quite a pileup, which was handled efficiently.

Other events included a transformer-throwing contest won by Eeva OH3ST. A small group of accompanying OMs were allowed to participate, and "the OH hams won thanks to superior transformer-handling technique and the famous Finnish SISU (stamina)." [Opinions expressed by correspondents for *73* International are not necessarily those of the magazine, which does not want to start a war—and the International Editor once knew a Swede from Karlskrona who. . . but that's another story.] Next year the meeting is planned for some place in Sweden.

NEW SWEDISH CALLBOOK

Up to the late 70s the Swedish licensing authority, Televerket, annually published a callbook including all amateurs in Sweden and sent it free of charge to all license holders. Then suddenly it ceased to come and no explanation was given, but we were promised a new book, every year. After five years and no callbook, Tage SM6GDL started to publish *Tage's List*, a callbook he must have spent a fortune on phone calls to keep up to date—a tremendous job; it seems that hams are changing QTHs more often than average people. He included repeater maps, the DXCC list, antenna-construction articles, and other valuable things in his book—which recently was renamed *The Amateur Radio Guide*.

Much to everybody's surprise this summer, every licensed ham in Sweden received, free, a new SM callbook from Televerket, including a name and QTH index which is very useful. It now will be published annually and can be subscribed to for 40 Swedish kroner (about US $6) or about half the price of Tage's book. Single copies are 60 Sw. kroner. It is called *Amatorradioforteckning E:22* and may be ordered from Televerket Radio, RFT, S-123 86 Farsta, Sweden.



SWITZERLAND

Heinz Mueller HB9BOS
PO Box 119
CH-4144 Arlesheim
Switzerland

DIG Schweiz (Diploma Interests Group, Switzerland) was formed last September by HB9BNQ, HB9DDZ, and HB9BOS, as a section of DIG Germany. The club station is HB9DIG (and counts three points toward the DIG Member Award). The group was formed on the basis of an opinion survey which resulted in an expression of favor by 50% of those participating. Purposes of the group include fostering greater activity, better discipline on the air, and courtesy on all amateur wireless bands.■

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Nel-Tech Labs		digital voice keyer	Sep 20
Nemal		connectors	Jun 19
Ohm/Electronics		Scooter surge protector	Nov 18
Orion Hi-Tech		RC5A antenna rotators	Jul 20
Ovonic		Compact Silent Generator	Jun 18
P.C. Electronics		GaAsFET ATV downconverter	Sep 20
PacComm		TNC-200	Feb 66
Palomar Engineers		Tuner Tuner	Sep 21
R. A. Kent		Morse key kit	Jul 21
Radio Engineers		oscilloscope frequency extenders	Oct 16
Rapid Systems		4X4 digital oscilloscope	Oct 16
Rapitech Systems		Acticon connector	Jun 18
Regency Electronics		HX1200 scanner	Apr 18
Regency Electronics		HX1500 scanner	Oct 17
Regency Electronics		MX-5500 scanner	May 18
Resultant Engineering		R-2000 repeater controller	Jul 21
Selco Products		custom-printed knobs and dials	Aug 22
Selectone		CTCSS encoder/decoder	Jul 21
Selectone		ST-130 Digitone CTCSS encoder	Jan 76
Sencore		Z-Meter 2	Jul 20
Shure Brothers		550L microphones	Oct 16
Sibex		610 oscilloscope memory	Jul 20
Sony		ICF-2010	Dec 19
Standard Communications		RP70K	Dec 18
Stone Mountain Engineering		757 QSYer	Dec 19
TAB Books		DX Power: Effective Techniques for Radio Amateurs	May 18
Technigroup		TravelComm 1200	Aug 23
Torontel		SSTV system	Nov 18
Trio Technology		PC Code-Pro	Dec 19
Uncle Bill's Fine Software		antenna design package	Mar 65
Uncle Bill's Fine Software		Commodore code course	Mar 64
VoCom		power amps	Feb 66
Winner's Edge Software		Contester II	May 18
Winner's Edge Software		COWW module	Oct 17
Wm. M. Nye		ORG Display	Jul 21
Xcelite		coaxial stripper	Oct 17
Xcelite		crimper	Dec 18
Xcelite		cutting pliers	Nov 19
Yaesu		AD-2 Duplexer	Sep 21
Yaesu		FT-767GX	Aug 22
Yaesu		YS-60/500 meters	Mar 65

Power Supplies

A Better Money-Maker	WA6TTY	13.8-V 20-Amp power supply	Jan 42
A Pedal-Pushing Power Plant	WA8WTE	bicycle power generator	Nov 50
A Power Supply Primer: Part I	K4IPV	everything you need to know about dc	Nov 26
Total Solar	WB8VGE	turn sunshine into sine waves	May 60

Receiving

A Connoisseur's Microwave Converter	Harry	cheap and good	Apr 45

Agc, PDO	KX6E	simple add-on agc	May 66
Halt That Hum!	WA4WDL	filter for 60-Hz hum	Mar 17
Just the FAX, Ma'am	WB8TPD	one-chip WEFAX decoder for the C-64	Oct 24
Make The Switch	WB2JJX	add WARC bands to your boat anchor	Dec 26
Microwave Building Blocks: The I-f Amplifier	WB8IGP	one tiny chip does it all	Oct 42
Narrow-Minded Filtering	WA3IAC	one-chip switched cap filter	Dec 46
One Band, One Transistor	WB2EUF	quick and dirty pocket receiver	Oct 54
Razor-Sharp CW	N8HI	is an 80-Hz filter too wide?	Feb 10
Shoestring Shortwave	K1CLL	simple shortwave receive converter	Oct 34
Subaudible Snooping	KE6VK	very-low-frequency counter	Nov 48
Super-Selectable Bandpass Filters	PA8SE	the ultimate i-f filter	Feb 54
The DXer's SCF	NB9K	the ultimate switched cap filter	Oct 46
The Hula Hoop Loop Revisited	W6QIF	deep nulls for the low bands	May 42
The RIT Stuff	K1NYX	RIT for the FT-101E	Feb 44
Transmitter Hunters: Here's Your Ammo For Tracking	WB8CMC	ultra-sensitive 2m fox-hunter	May 50
Two to Ten	WB5IPM	transceiving converter	Jun 38
WARC, Rest, and Play	K7KQ	add 10 MHz to the FT-101Z	Feb 82

Repeaters

CoCo's Compu-Charger	K2OAW	world's smartest NiCd conditioner	Sep 70
Digital Simplex Repeaters	K4YKZ	a cross between packet radio and repeaters	Jun 48
Run Silent, Run Beep	PY2AUC	scan indicator for the FT-227RB	Jan 40
The Piggy-Bank Patch	KT2B	autopatch for the Piggy-Bank repeater	Jul 40
Those Tantalizing Twos	AL7DS	scanning for the IC-2AT and -02AT	Jun 60

Reviews

AEA	AE5V	Hamcom Terminal Software	Aug 28
AEA	KW1O	PAKRATT 232	Dec 24
AEA	K9EI	PK-64 PAKRATT	Feb 72
Alinco Electronics	KT2B	ELH-220GF power amplifier	Nov 20
Ampro	WA8WTE/4	Little Board	Aug 24
Dick Smith Electronics	KT2B	Commander VHF FM transceiver	May 26
Dick Smith Electronics	WB6PHE	100-W VHF amplifier kit	Nov 22
Dick Smith Electronics	WB6PHE	440-MHz mobile transceiver	Oct 18
G.W. Morse Keys	VE7BS	PEP/B conversion module	Feb 73
Gary Field	KR3T	WA1GRC TPS-1 power-supply kit	Feb 73
Heathkit	N1BLH	HD-3030 interface	Jul 23
Heathkit	N1BLH	HO-5404 station monitor	Sep 24
Heathkit	N1BLH	HOA-5404-1 Pan Adapter	Oct 20
Heathkit	KW1O	HS-148 computer	Dec 22
Heathkit	Danzer	IO-4225 oscilloscope	May 22
Heathkit	KW1O	IP-2760 Battery Eliminator	Nov 24
Horse Sense Software	KW1O	Radio Interference Analysis	Jan 68
Horse Sense Software	KW1O	Radio System Design Calculations	Jan 68
ICOM	KT2B	IC-1271A 23-cm multimode	Sep 22
ICOM	W1XU	IC-27A	Jan 70
ICOM	KT2B	IC-471A	Jun 20
Isotron	KF4PW	160m antenna kit	Mar 58
Kenwood	KT2B	TH-31AT	Jul 22
Kenwood	KT2B	TS-811A	Jun 20
Kit Corner: Build A Two-Tube Vintage Receiver	Whitby		Sep 66
Kit Corner: The DSE 500-MHz Frequency/Period Counter	KW1O		Aug 90
Lance Johnson Engineering	KW1O	Kansas City Keyer	Mar 58
MFJ	N1BLH	MFJ-1207 TNC-2	Jun 24
Microwave Modules	KT2B	MML/200-S power amplifier	Mar 62
Microwave Modules	KT2B	MMT 144/28R transverter	Mar 59
Mirage/KLM	KT2B	C22 A power amplifier	Nov 20
Nel-Tech	WB8BTH	DVK-100 digital voice keyer	Dec 20
Regency Electronics	N1BLH	MX-7000	May 20
SSB Electronics	KT2B	MV 220 preamplifier	Apr 84
SSB Electronics	KT2B	PA2310 power amplifier	Apr 83
Tonna	KT2B	55-element antenna	Apr 83
Triangle Elsctronics Laboratories	KF4PV	MK-800 memory keyer	Jan 66
Twin Oaks Associates	WD9EDT	C.W. Tutorsoft and C.C. Testmaster	Feb 72
Uniden-Bearcat	N1BLH	800XTL	May 20
Yeesu	WB9LSS	FT-209RH HT	Jan 66
73's Packet Buying Guide	Staff	goodies and where to get them	Aug 66

RTTY

A Packet Primer	W1BEL	the mechanics of packet	Aug 26
And If That Isn't Enough...	NK6K	packet Q&A	Aug 80
Beyond Level Two	KA9Q	packet networking	Aug 74
Birds 'N' Bauds	NK6K et al	flying packet satellites	Aug 58
Commodore's RTTY Riot	W8CHK, WB8YOB	put your C-64 on RTTY	Nov 34
Connect Alarm!	K7YZZ	one-hour u-build-it	Aug 66
How To Make Friends At 1200 Baud	W2JUP	operating packet	Aug 34
On The Shelf	NK6K	packet bibliography	Aug 86
Precision Packet Tuning	WB2OSZ	world's best packet/RTTY tuning indicator	Aug 40
Roll A RTTY Scope	WA8MRG	tuning indicator with built-in CRT	Jul 28
Seeing Packet Radio With Different Eyes	N7FDS	how a blind ham copes with packet	Aug 48
So You Want To Be A Sysop?	WB2MNF	secrets of a successful packet BBS	Aug 50
Survival Training For Mountaintop Digipeaters	WB6RAL	practical tips	Aug 66
Terminal Teletype	W3RWU	RTTY for the H-89	Apr 62
The Perfect RTTY Filter	WA8MRG	less than $10	Jan 46
Working 2ICTU	WB8OMK	two-chip RTTY TU	Jan 54

Test Gear

Don't Be A Kamikaze!	KA4J	improvement on the suicide cord	Mar 30
Rebirth of the Eico 221	W5VTJ	super-sensitive surplus voltmeter	Feb 51
Rock Solid Rf	Ociepka	PLL-based frequency synthesizer	Apr 74
Roll A RTTY Scope	WA8MRG	tuning indicator with built-in CRT	Jul 28
Subaudible Snooping	KE6VK	very-low-frequency counter	Nov 48
They Threw What Away?	WA8WTE	surplus UHF swr bridges	Jun 56
Troubleshooting With the DMM	Davidson	step-by-step tutorial	Jul 58
Your Bridge Over Troubled Antenna Tuning	W3MT	matching box	Apr 24

Theory

A Packet Primer	W1BEL	the mechanics of packet	Aug 26
A Power Supply Primer: Part I	K4IPV	everything you need to know about dc	Nov 26
A Simple Way to Measure SSB PEP	W5VSR	use a little common sense	Oct 40
And If That Isn't Enough...	NK6K	packet Q&A	Aug 80
Are Sine Waves Sacred?	W6HDM	the benefits of trapszoidal power	May 44
Beyond Level Two	KA9O	packet networking	Aug 74
Birds 'N' Bauds	NK6K et el	flying packet satellites	Aug 58
Build A Digital IC Trainer	WB4YOD/PW8ZAF	for the experimenter	Mar 40
Defuse RFI	W6WUZ	the coaxial ground revisited	Nov 32
Digital Simplex Repeators	K4YKZ	a cross between packet radio and repeaters	Jun 48
Easy Digital Circuit Analysis	K5VKO	Boolean algebra for the masses	Apr 88
Genius Brings Home the Bacon	Phenix	the Mobius antenna takes on a new twist	Jul 52
How To Make Friends At 1200 Baud	W2JUP	operating packet	Aug 34
Japan's Hush-Hush Rushbox	PA8SE	secret radio from WWII	Mar 9
Little or No Resistance	AJ6N	mysterious world of superconduction	Jan 36
Make the Switch to PIN Diodes	OA4KO/YV5	replace relays with silent diodes	Oct 26
Messing With Microwaves	Neal	construction techniques	Jun 52
New Bands for Old Rigs	GW3SB	add three WARC bands onto your boat anchor	Feb 16
No Free Lunches	W6HDM	perpetuel motion update	Nov 42
On The Shelf	NK6K	packet bibliography	Aug 86
Resonant Wire Antennas	W6VM	random-length wires	Sep 80
Rock Solid Rf	Ociepka	PLL-based frequency synthesizer	Apr 74
Scaling the Wet Noodle	W5RRH	modeling low-band antennas	Sep 40
Seeing Packet Radio With Different Eyes	N7FDS	how a blind ham copes with packet	Aug 48
Selcal and State Machines	WA7NBF	state machine tutorial	Jan 28
So You Want To Be A Sysop?	WB2MNF	secrets of a successful packet BBS	Aug 50
Super-Selectable Bandpass Filters	PA8SE	the ultimate i-f filter	Feb 54
Survival Training For Mountaintop Digipeaters	WB6RAL	practical tips	Aug 66
The Care & Feeding of a Curved Linear Array Antenna System	N6BIS	all-band trailer installation	Apr 30
The Match Maker	VE3LMP	what's all this about impedance matching?	Apr 38
Transistors On The Bias	W6WTU	how to bias transistor amps	Nov 40
Trap An Amazon Aerial	WB4YOD/PW8ZAF	home-brew your own traps	Sep 58
Troubleshooting With the DMM	Davidson	step-by-step tutorial	Jul 58
Watts My Line	K4IPV	Basic transmission line design program	Sep 36
Yesterday's Circuits Today	W6HDM	favorite tube circuits	Feb 28

Transmitting

A Simple Way to Measure SSB PEP	W5VSR	use a little common sense	Oct 40
A VOX In A Box	K1NYK	endless-loop CQer	Dec 34
Everybody Equalize!	K9EID	optimizing microphone response	Dec 44
Make The Switch	WB2JJX	add WARC bands to your boat anchor	Dec 26
Melley's Manchester Monitor	K1NYK	monitor your transmitted audio	Apr 86
Two to Ten	WB5IPM	transceiving converter	Jun 38
WARC, Rest, and Play	K7KQ	add 10 MHz to the FT-101Z	Feb 82

VHF/UHF

A Connoisseur's Microwave Converter	Harry	cheap and good	Apr 45
Antennas Should Be Heard, Not Seen	KC3HW	2m hidden J-pole	Apr 42
Birds 'N' Bauds	NK6K et al	flying packet satellites	Aug 58
Build a Dynamic Duo	VE1VO	speaker/mike and 12-V adapter for your HT	Feb 40
Digital Simplex Repeaters	K4YKZ	a cross between packet radio and repeaters	Jun 48
Dishing It Out On 10 GHz	WB8IGP	microwave feeds and antennas	Sep 48
Faster Than A Patch, It's Speed Dialer	K7UKW	one-button autodialer	Mar 20
Messing With Microwaves	Neal	construction techniques	Jun 52
Microwave Building Blocks: The I-f Amplifier	WB8IGP	one tiny chip does it all	Oct 42
Nobody Died	KT2B	experiences of a first-time contester	Dec 40
Razzle-Dazzlin' Your Azden	K7UKW	multi mods for the PCS-2000	Feb 20
Run Silent, Run Beep	PY2AUC	scan indicator for the FT-227RB	Jan 40
Scanning the TR-2400	WB8IKO	quick and dirty	Feb 42
Speed-Charge Your PB-21	WA8IZV	fast charger for the TH-21	May 32
The Piggy-Bank Patch	KT2B	autopatch for the Piggy-Bank repeater	Jul 40
They Threw What Away?	WA8WTE	surplus UHF swr bridges	Jun 58
Those Tantalizing Twos	AL7DS	scanning for the IC-2AT and -02AT	Jun 60
Transmitter Hunters: Here's Your Ammo For Tracking	WB8CMC	ultra-sensitive 2m fox-hunter	May 50
Up, Down, and All Around	WA2AXO	scanning for the KDK 2016A	Feb 36

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PROPAGATION

Number 21 on your Feedback card

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	15[1]					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15	15	15	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WEST COAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15[1]	20[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

December is the solar cycle minimum, and HF propagation will be poor on the higher frequencies, with early band closings on and above 14 MHz. Unsettled to active magnetic field conditions will cause fair daytime conditions where noted. Magnetic storm levels may be reached on the 4th through the 6th, resulting in very bad propagation on east-west paths. North-south paths could be interesting. Look for unusual ionospheric propagation on 6 meters and above during the first week.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F	2 P	3 F-P	4 P	5 P	6 P
7 P-F	8 F-G	9 F	10 G	11 G	12 G	13 G
14 F-P	15 P	16 P-F	17 G	18 G	19 G	20 G
21 G	22 F	23 F-P	24 P	25 P-F	26 F	27 G
28 G	29 G	30 G	31 G			